NASA INFORMATION SYSTEMS MARKET

1991 - 1996

INPUT

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Abstract

NASA was established as an independent agency responsible for conducting space and aeronautical activities for peaceful and scientific purposes. The agency operates within a decentralized management and program structure. Since its many research and space centers have different functions, most of the information systems planning originates at the centers in support of specific program activities.

Historically, NASA has always made extensive use of contracted services in performing mission activities. INPUT has analyzed the agency's budget submissions and estimates that the contracted portion of NASA's information systems budget will increase from $1.5 billion in 1991 to $2.6 billion in 1996, an average annual growth rate of 11%.

This report examines the planning and procurement processes at NASA and details some of the major information systems and programs. It also identifies several of the initiatives being developed to centralize selected administrative and mission support functions.

This report contains 162 pages, including 58 exhibits.

NASA Information Systems Market 1991-1994

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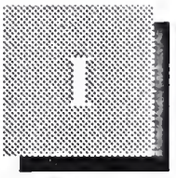


Introduction

The *NASA Information Systems Market, 1991-1996* is a revision of an earlier report issued in 1988. The 1991 update identifies market issues and trends that affect vendors and information technology contractors entering the market through FY 1996.

This report on the information systems market within the National Aeronautics and Space Administration (NASA) was prepared as part of INPUT's Federal Information Systems and Services Program (FISSP). Many FISSP clients requested that INPUT analyze and report on information systems (IS, including services, hardware, and software) opportunities within NASA as one source of information supporting business decisions regarding pursuit of NASA opportunities.

The report's findings are based on research and analyses of several sources:

- INPUT's Procurement Analysis Reports (PARs)
- OMB/GSA/NBS Five-Year Information and Technology Plans for 1991-1996
- Recent interviews with NASA policy makers and planning officials
- Past interviews with NASA policy officials, contracting officers, and program managers
- Past interviews with industry marketing and administrative executives
- Pinpoint, Inc.'s analysis of NASA contract awards

A
Scope

This report provides an overview of NASA's mission and organization, and its planning and acquisition process. It discusses the major programs and initiatives of the agency headquarters and research and space centers. The report also discusses the agency's current and planned use of information systems as identified through interviews with selected NASA agency officials.

The report gives details on some of the information systems opportunities listed in the OMB/GSA/NBS Five-Year Plan for government fiscal years FY 1991 to FY 1996, and available agency ADP Plans.

Interviews with NASA policy and planning officials were conducted for this report. Vendor interviews were not conducted for this revision. Vendor information was obtained from surveys performed for the 1988-1993 version of this report.

B
Methodology

The OMB/GSA/NBS Five-Year Plan analysis and the INPUT Procurement Analysis Report were reviewed for programs to be initiated during the period of interest. The available agency plans for FY 1991-FY 1996 were researched to identify plans for major initiatives and programs.

The Federal Government Information Technology Budget requests provided in response to OMB Circular A-11, Sections 43A and 43B, for FY 1991 to FY 1996 were analyzed to identify significant spending changes and funding levels.

Concurrently, the mission of each NASA organization was defined, along with the role of IS in fulfilling this mission. INPUT analyzed discrepancies between the desired IS role and the actual IS role that would lead to an initiative for improvement.

INPUT also reviewed the Procurement Analysis Reports (PARs) to develop further insights into agency activities. Many PARs cover programs that, for one reason or another, do not appear in the agency's budget submissions. The situation yields additional possibilities for further research.

A copy of the most recent agency questionnaire is included in Appendix F.

C
Report Organization

This report consists of six additional chapters:

- Chapter II is an Executive Overview describing the major points and findings of the report.
- Chapter III covers the mission and organization of the agency, along with the structure and functions of NASA's information systems.
- Chapter IV provides the market forecast for each market segment of the information technology market, and NASA's funding patterns.
- Chapter V presents the major programs and initiatives under way at the agency.
- Chapter VI summarizes the acquisition plans and procedures utilized by the agency.
- Chapter VII presents the vendors perspectives on NASA's information systems market.

Several appendixes are also provided:

- Interview Profiles
- Definitions
- Glossary of Federal Acronyms
- Policies, Regulations, and Standards
- Related INPUT Reports
- Questionnaires

II

Executive Overview

A
NASA Centralization Initiatives

Throughout its history, NASA has used computers extensively for administrative systems and mission support. Also, throughout its history, NASA has functioned in a highly decentralized mode. These two practices have combined to produce complex, highly effective information systems dedicated to supporting specific programs.

As this report shows, NASA has undertaken changes to require more information sharing than at any time in its history. It would be an oversimplification to suggest that NASA is centralizing its systems. Rather, in selected areas, it would be more accurate to say that NASA is moving away from its traditionally decentralized approach. Exhibit II-1 lists some examples of this change.

EXHIBIT II-1

NASA Centralization Initiatives

- Software Support Environment
- Technical and Management Information Systems
- Software Management and Assurance Program
- Procurement Management Technology Program
- NASA Occupational Health Management Information System

- The Software Support Environment, tied to the Space Station program, will provide an overall NASA software framework for the 1990s;
- The Technical and Management Information System (TMIS) will support the dissemination of Space Station information to other programs.
- The Software Management and Assurance Program (SMAP) will enhance software quality and software exchange among the various centers.
- The Procurement Management Technology Program will result in an agencywide standard automated procurement system.
- The NASA Occupational Health Management Information System (NOHMIS) will result in an automated agencywide information system that will provide information for health personnel at all NASA installations.

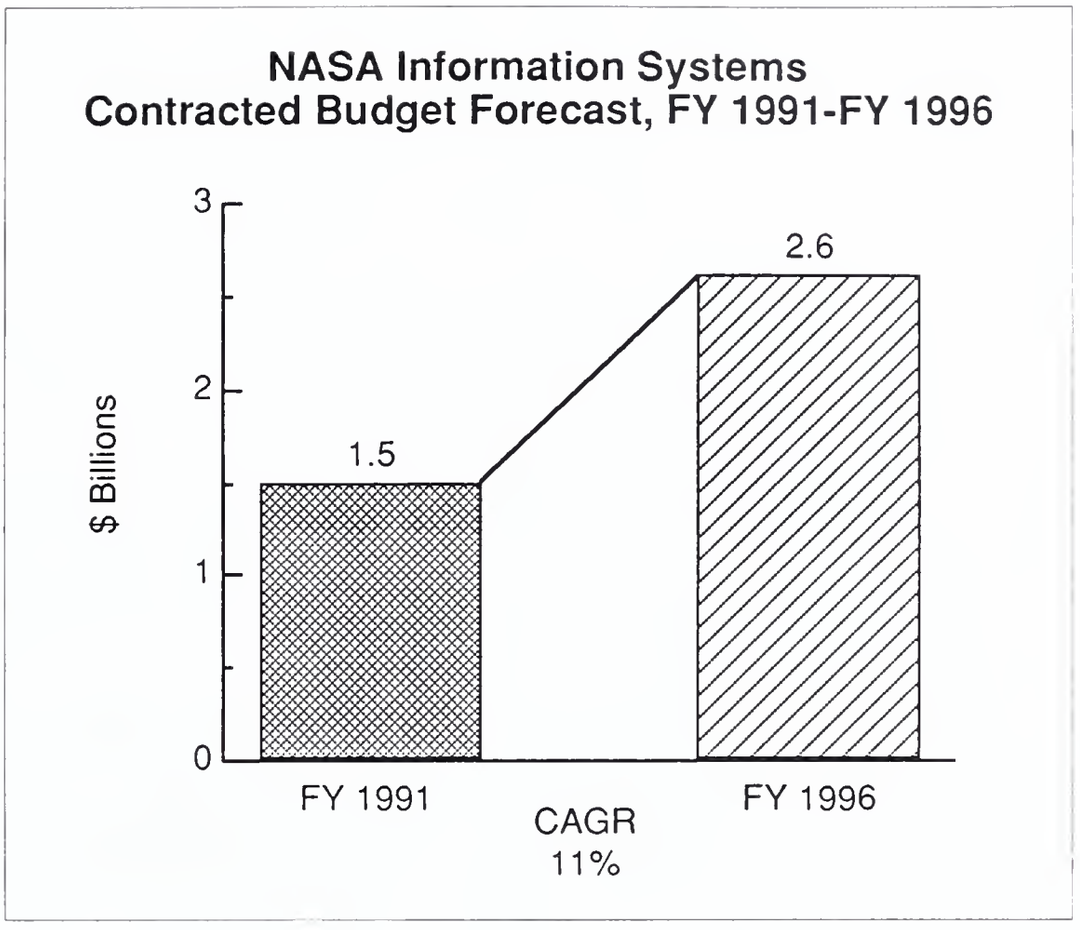
These last two systems are being developed under the Automated Information Management Program (AIM), which aims to improve the delivery of administrative and management support programs.

B

NASA Market Forecast, FY 1991-FY 1996

INPUT estimates that the contracted portion of NASA's information systems budget will grow from $1.5 billion to $2.6 billion, as shown in Exhibit II-2. This represents a compound annual growth rate (CAGR) of 11%. Section IV contains a detailed breakout of this forecast.

EXHIBIT II-2

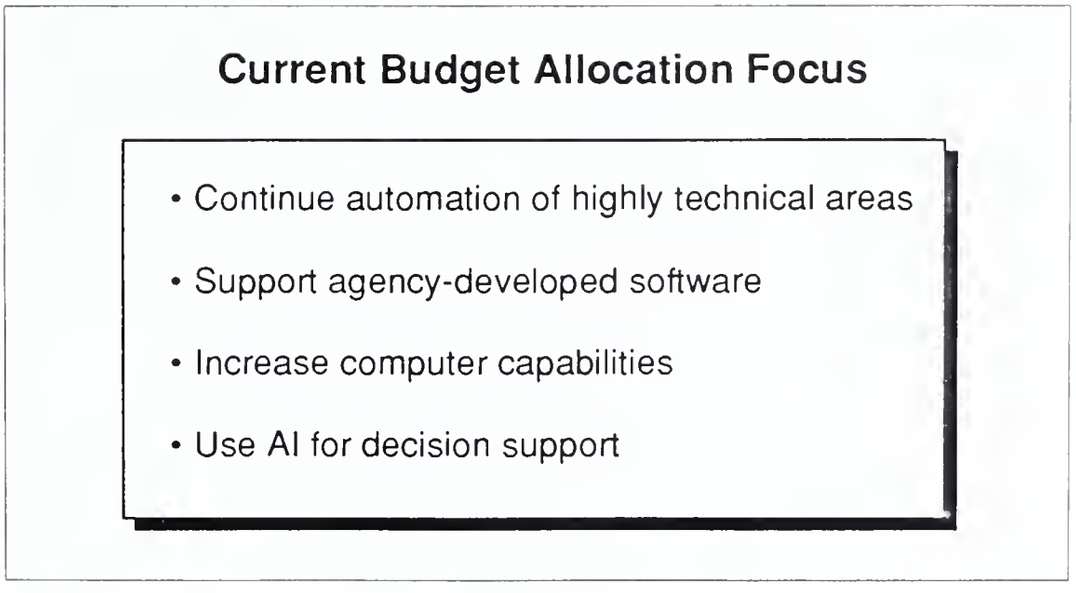


C

Current Budget Allocation Focus

In allocating its information technology budget, NASA focuses on four primary areas. These are listed in Exhibit II-3.

EXHIBIT II-3



Historically, NASA has not always been on the leading edge of information technology. Reports from various oversight agencies have suggested a need for improvement in this area. As a result, NASA has initiated a wide-ranging program to intensify its automation of highly technical areas. For example, in the telecommunications area, NASA has established several sophisticated local-area networks to facilitate information sharing.

NASA has also taken various steps to support and improve its own developed software. Section A mentioned the SMAP initiative. NASA has also established several intercenter committees to strengthen its overall software profile.

The various NASA centers are also pursuing a significant upgrade of their computer facilities, especially in the mission support area. INPUT's review of NASA's most recent OMB Circular A-11 Section 43B submission indicated that significant hardware upgrades, replacements, and new starts would be taking place over the next five years.

Finally, NASA has begun using artificial intelligence (AI) to enhance its decision support activities. For example, when combined with graphics AI can be used to analyze satellite data according to certain pre-established criteria. This effectively reduces the amount of analysis to be performed by humans, and also focuses the analysis.

D

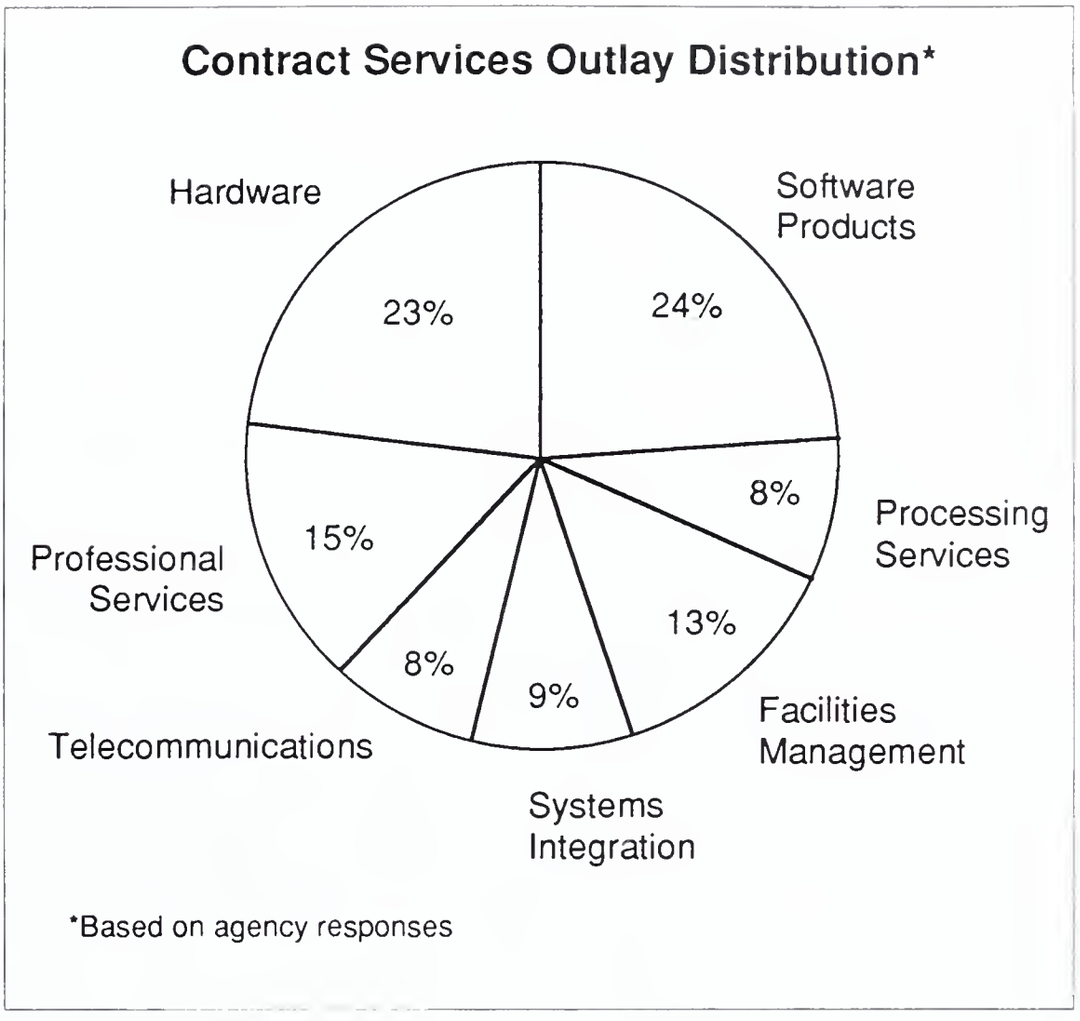
Contract Services Outlay Distribution

Traditionally, NASA has used contractors more than most agencies in performing mission activities. The contract services outlays, as described by NASA personnel, appear in Exhibit II-4.

Based on agency responses, software just slightly edged out hardware. Although the difference is too small to be statistically significant (and is not reflected in the A-11-43B data), it does illustrate the important role that software plays in NASA's acquisition plans.

Unlike many other agencies, NASA does not identify heavy spending for systems integration. This stems from the fact that most centers, and the headquarters, already have on-site vendors doing the integrating. For example, at the Kennedy Space Center, Lockheed is managing the upgrade of the Launch Processing System, including significantly improved data base capabilities. Also, NASA employs its own computer specialists and performs much of its own systems integration.

EXHIBIT II-4



E

Major Information System Plans

NASA's ongoing information system plans for the FY 1991 budget year and for most of the next decade focus on completing systems in place and initiating new or replacement systems that support funded missions. Emphasis is being given to two new initiatives, the Space Station and the Earth Observation System, and to activities aimed at modernizing information resources that support ongoing aerospace and orbital missions. These programs are listed in Exhibit II-5 by their acronyms, and are detailed in Chapter V.

The Space Station Program (SSP) systems will support both the early and later phases of NASA's dominant program of the 1990s. The sheer size and complexity of the Space Station, including involvement of many contractors, most NASA Centers, and a number of international organizations, require services that support rapid, timely, and accurate interchange of information. The two main systems listed will support construction and operation of the Space Station and coordinate dissemination of scientific data.

EXHIBIT II-5

Major Information System Plans

- Space Station Program (SSP)
  - TMIS
  - CDOS
- Earth Observation System (EOS)
  - ECS
- Major Independent Systems
  - NAS
  - SCOPAS
  - EADS

The Earth Observation System (EOS) is considered the second most important and complex NASA program. In particular, EOS will be a global observing system using polar orbiting platforms in space, which will transfer research and operational data through an advanced information system on Earth. The information system portion of EOS is the Earth Observing System Data Information System (EOSDIS). EOSDIS is estimated to be worth $800 million and the initial contract for EOSDIS, called ECS, will be worth approximately $500 million.

Independent major information systems are intended to improve intercenter data exchange, enhance ongoing data processing activities, and provide NASA management with more up-to-date information for decision purposes.

F

Component Group Growth Expectations

Independent of NASA's long-range plan observations, its OMB A-11 budget requests, and INPUT's own forecast, the government and vendor personnel were asked to estimate the direction and percent change in the agency's use of information service modes over the next five years. Exhibit II-6 highlights the tabulations and discussions found in Chapters VI and VII.

EXHIBIT II-6

Component Group Growth Expectations

Service Mode	Annual Growth Estimates (Percent)	
	Agency	Vendor
Software	25	25
Hardware	20	32
Processing	17	7
Systems Integration	10	50

Both groups concurred on the level of increase in software contract services, at 25%. NASA's documentation and implementation plans emphasize the importance of software to increasing capacity and systems performance.

The two groups were farthest apart in estimating the likely growth of systems integration. The agency respondents noted that many of the system replacements will be accomplished by the current on-site contractors, rather than by new competitive bids.

Although hardware and processing expectations were not significantly different between the groups, the differences were in direction. Vendors expect an increase in hardware acquisition, and the agencies expect more use of contractor off-site data processing as interim measures while new systems are being implemented.

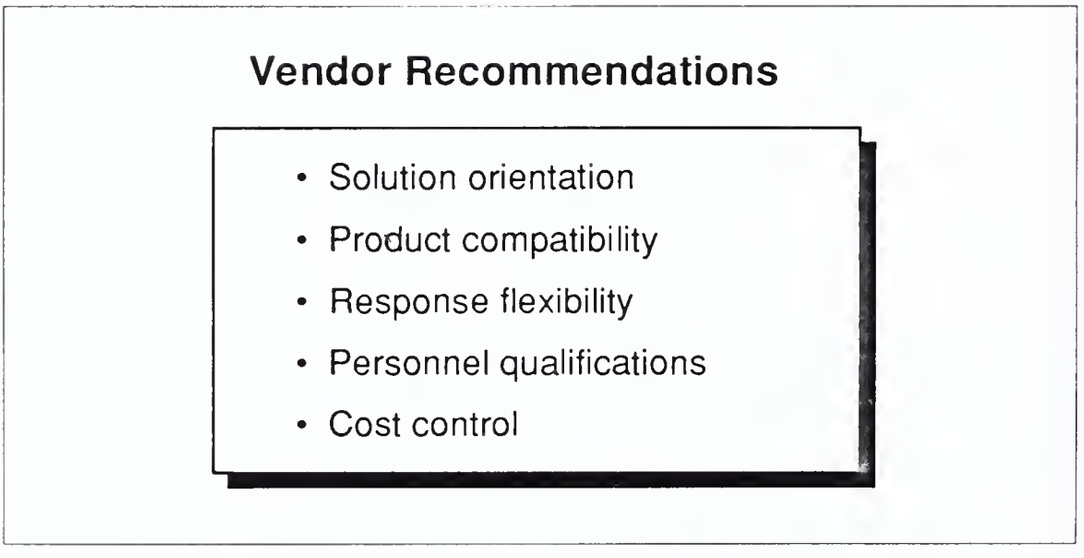
Other modes discussed in the text include professional services, telecommunications, and systems operations/outsourcing. The differences are about three to one—upward by vendors for professional services and the reverse for the other two.

G
Vendor Recommendations

Examination of the contracting structure of NASA reveals concentration in the field installations/centers and headquarters of most vendor activities. Entry into the NASA market is limited to teaming or subcontracting to incumbent center contractors, bidding for recompetition of the service contracts, or bidding on the few initiatives open to competitive bidding. Some research and development contracts are awarded sole source, but only in advanced science and engineering programs.

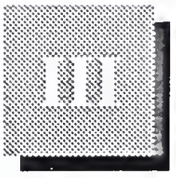
Exhibit II-7 highlights the characteristics selected by agency personnel as key to successful contract award and retention. The most important recommendation is the need to be solution oriented, since many NASA projects are performance and schedule oriented. Product compatibility is highly significant to potential software, hardware, and telecommunication suppliers. Even though NASA is not specifically name-brand sensitive, the agency does require interconnectivity.

EXHIBIT II-7



Service providers need to offer flexible response in management, support, technical staff, and level of effort. The experimental and exploratory nature of NASA missions automatically includes a significant degree of schedule and demand uncertainty. Personnel qualifications are emphasized because of this flexible and knowledgeable response requirement. The more successful NASA vendors have a disproportionately high percentage of professionals with advanced degrees.

Cost realism and control are particularly important in the NASA environment. The agency's expenditures are extensively scrutinized and balanced against other national programs, requiring the judicious utilization of available funding by the centers and the program offices.



Agency Overview

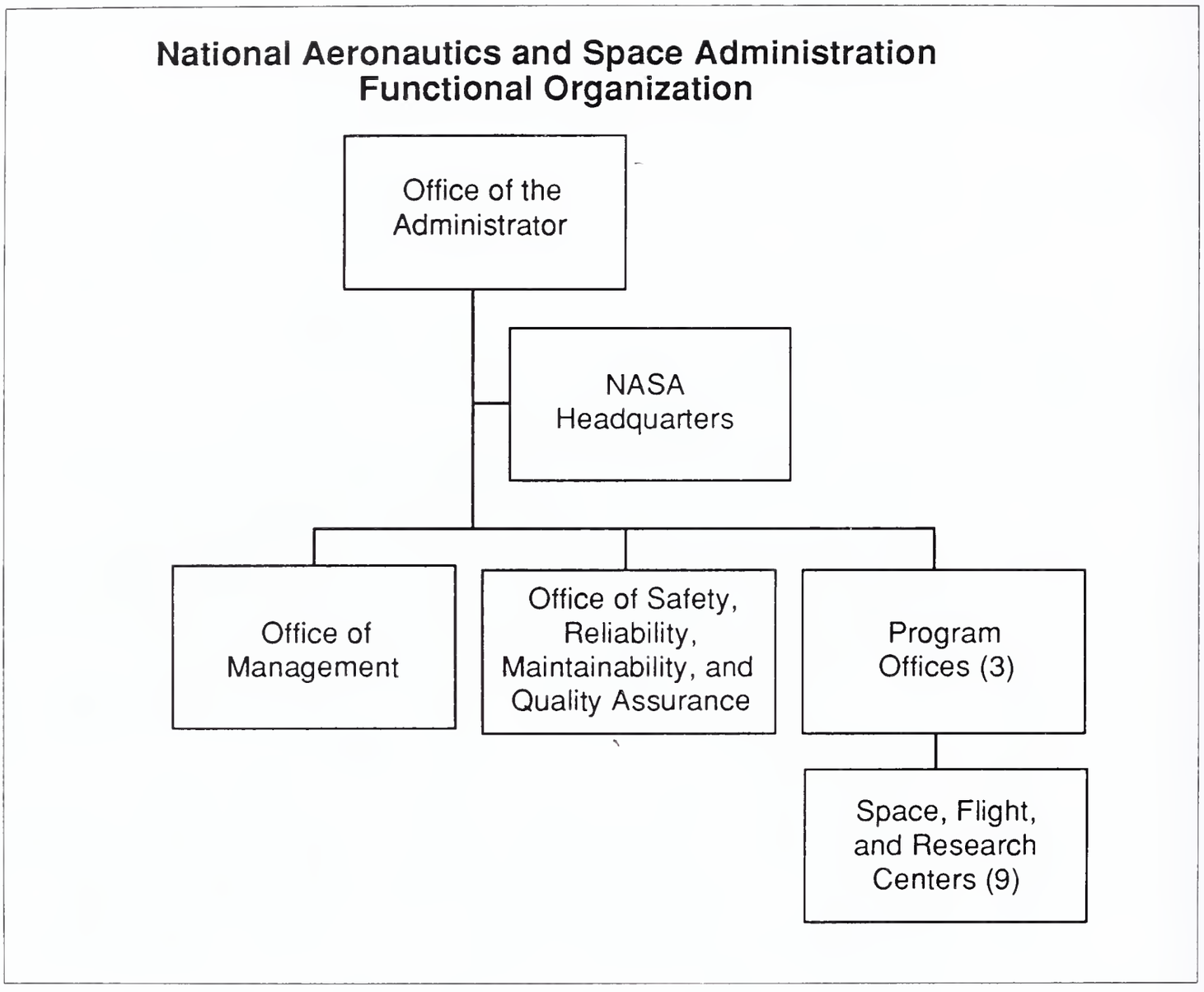
A
Mission and Organization

NASA was established in 1958 as an independent federal agency responsible for conducting space and aeronautical activities for peaceful and scientific purposes. The principal statutory functions include: fly within and outside the Earth's atmosphere, build and operate aeronautical and space vehicles, conduct manned and unmanned space exploration, cooperate with other nations in those peaceful activities, and provide wide dissemination of information. Some of NASA's specific objectives for the next decade, as stated in its fiscal 1991 budget, are to:

- Make the agency's Space Transportation System—of which the space shuttle is a key part—fully operational and cost effective
- Move toward the establishment of a permanently manned space station
- Conduct an effective and productive space and earth sciences program
- Conduct effective and productive space applications and technology programs

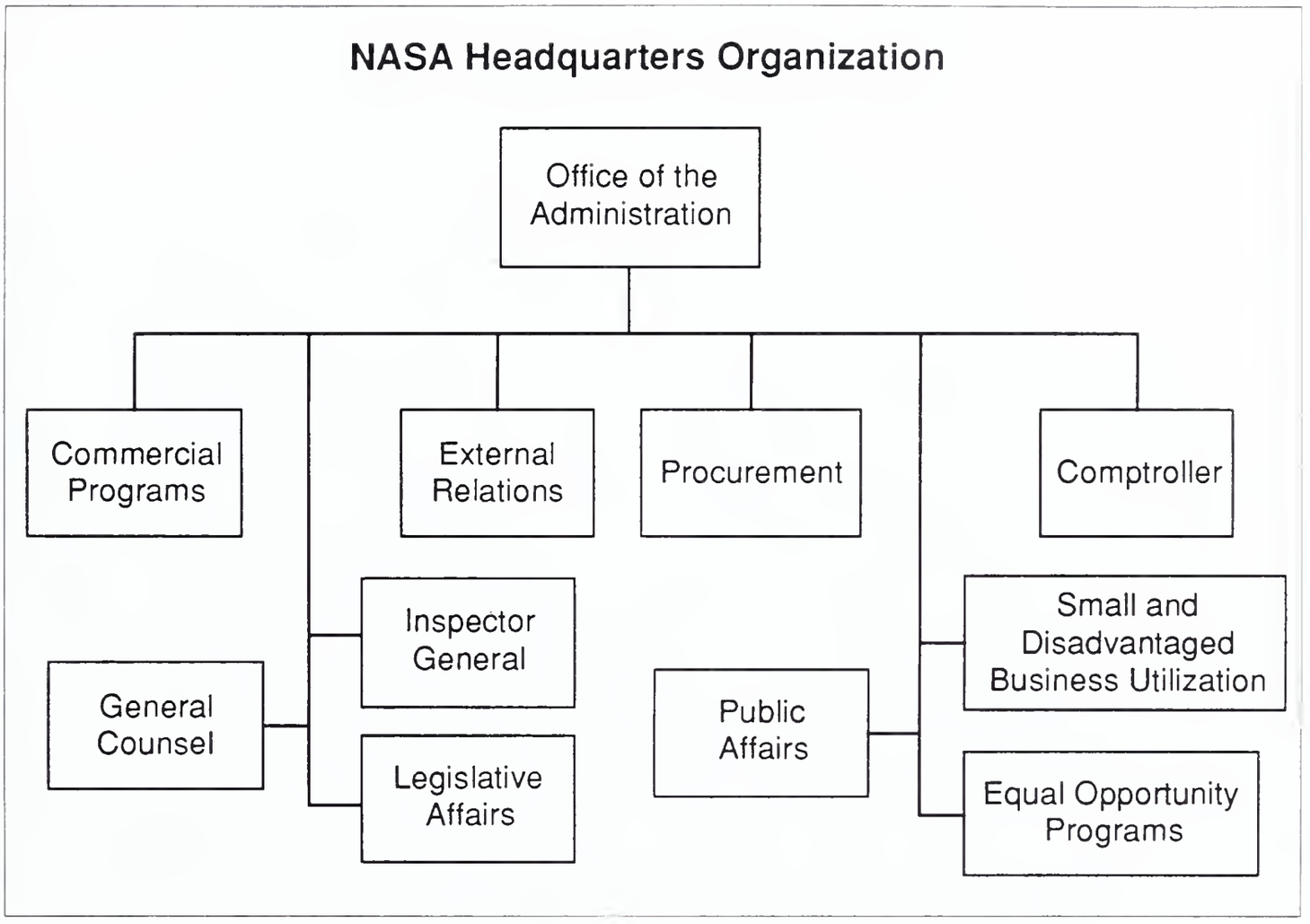
Planning, coordination, and control of NASA programs are vested in Headquarters, as indicated in Exhibit III-1. Directors of the Field Installations (Centers) are responsible for execution of NASA's programs, largely through industrial (vendor) contracts. Planning, direction, and management of NASA's research and development programs are the responsibility of four Program Offices, each headed by an associate administrator. The Program Offices and NASA Centers are separately discussed in this section.

EXHIBIT III-1



The administrator, Richard H. Truly, and his deputy, James R. Thompson, Jr., are supported by a headquarters staff that includes Central Procurement and the Commercial Programs offices, which play key roles in establishing contracting procedures and policy. The Office of Management, and the Office of Safety, Reliability, Maintainability, and Quality Assurance are also headed by associate administrators, in support of the program offices. An overview of the organizational structure at NASA headquarters is shown in Exhibit III-2.

EXHIBIT III-2



1. Program Structure

The planning, direction, and management of NASA's research and development programs are the responsibility of four program offices. The offices report to and receive overall guidance and direction from the agency Administrator. The four program offices and their major responsibilities are as follows:

a. The Office of Aeronautics, Exploration and Technology is responsible for coordinating and conducting programs to develop advanced research and technologies for pursuit of national objectives in aeronautics and space. It also handles the application of NASA capabilities and facilities to other federal agencies and the U.S. aerospace industry. This office is the focal point for the National Aerospace Plane Program and the Space Exploration Initiative. In addition, this office holds responsibility for managing the Ames, Langley, and Lewis Research Centers.

b. The Office of Space Science and Applications is responsible for efforts by NASA to undertake its study of the universe, solar system, and integrated evolution of the planet Earth. The office conducts activities and research in remote sensing, microgravity, and space communications. It also coordinates contact with other U.S. scientific advisory organizations. The office is responsible for managing the Goddard Space Flight Center and the Jet Propulsion Laboratory.

c. The Office of Space Flight is responsible for handling the space shuttle program and other space transportation programs. The Office develops and operates the Space Transportation System. It also manages and directs all launch activities and the development, procurement, and operation of the U.S. Spacelab. The Office of Space Flight is also responsible for managing and directing all aspects of the Space Station Freedom Program. This office manages the Johnson Space Center, Marshall Space Flight Center, Kennedy Space Center, and John C. Stennis Space Center.

d. The Office of Space Operations is responsible for tracking, command, telemetry, and data acquisition support to NASA programs, which include Earth-orbital science and application missions, planetary missions, research aircraft, and the Space Transportation System. It maintains a global communications system to link facilities that provide data processing for mission control and telemetry for space missions.

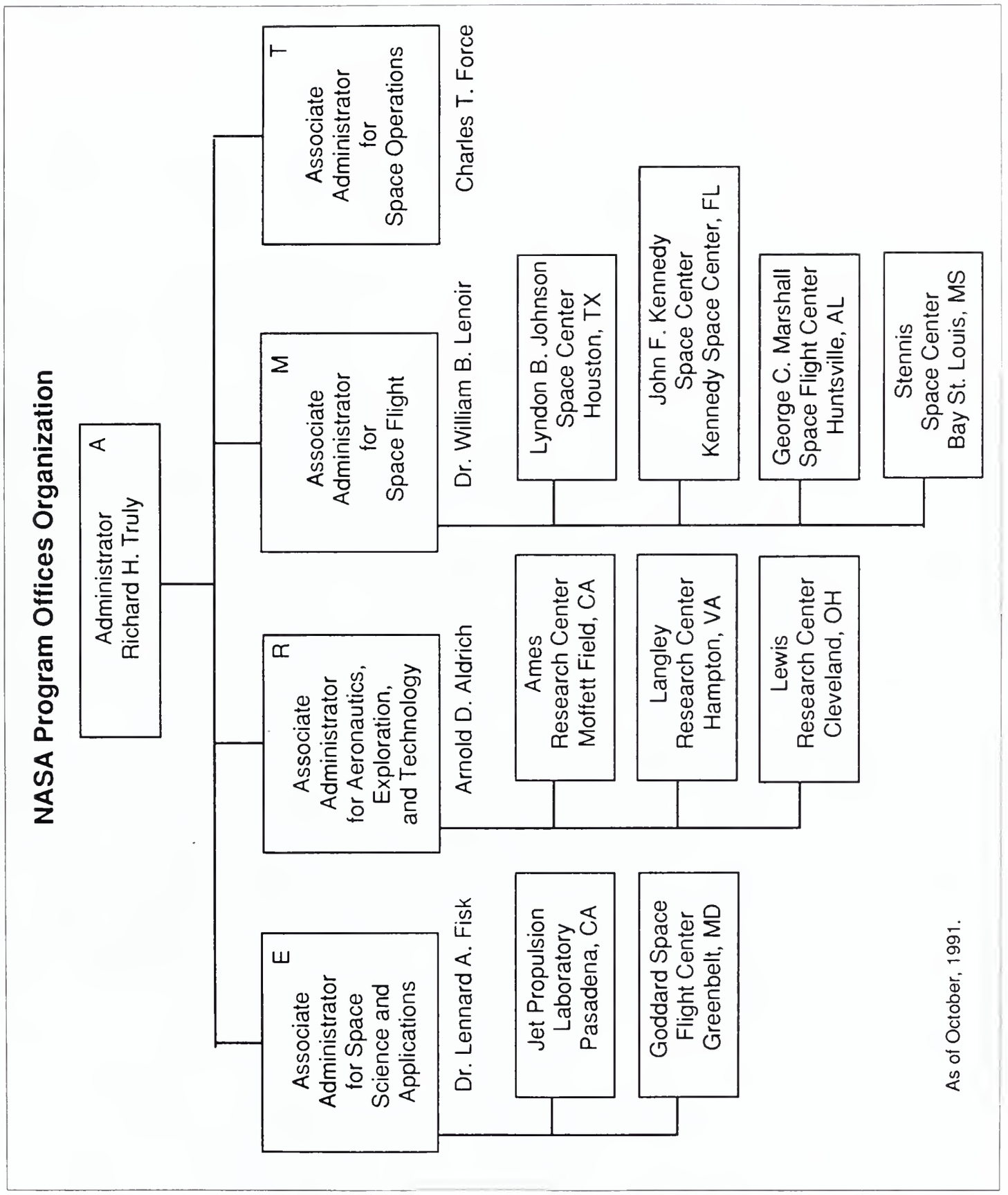
Three of the program offices at NASA headquarters oversee NASA's research and flight centers. Exhibit III-3 is an organizational chart that illustrates the associate administrator to which each space center and research center is reporting.

The Office of Aeronautics and Space Technology has institutional responsibility for the three research centers and supports the space flight centers in areas essential to the Space R&T program. It distributes the work of the Space R&T program according to the capabilities for specialized research established at each field center. The space flight centers that support flight development programs and operations are managed by the Office for Space Flight.

NASA has two organizations that oversee the use of information technology: the Information Resources Management Division (within the Office of Management) and the Software Management and Assurance Program (within the Office of Safety and Mission Quality Assurance).

The Associate Administrator for Management is responsible for issuing policy guidance on the management of information technology. One form of this guidance, a handbook that is reviewed annually and updated as needed, lists procedures, policies, and responsibilities for the planning and acquisition of such technology. This provides agencywide guidance for planning the development of information technology and monitoring hardware and software acquisitions.

EXHIBIT III-3



Additionally, the Office of Management is preparing, for the first time, a long-range plan that will contain proposed resource acquisitions for the next five years. Until now, each organization within NASA developed its own IRM plan. The NASA IRM department estimates this FY 1992-FY 1997 plan will be published in May 1992.

2. NASA Centers

Nine Field Installations or Centers support NASA activities. Each Center performs (relatively) unique functions, often on different programs, in support of NASA's overall mission. The relationship between each center and its principal program is illustrated in Exhibit III-3.

a. The Lyndon B. Johnson Space Center (JSC), located in Houston Texas, manages the development and operation of the space shuttle. NASA expects the shuttle to reduce the cost of using space for commercial, scientific, and defense needs. The Johnson Space Center oversees development of the orbiter vehicle, the portion of the shuttle that carries crews and experiments into space. Johnson also directs the design, development, and testing of spaceflight payloads and associated systems for manned flight. Johnson serves as the lead center for the Space Shuttle Program, providing technical and programmatic management in the areas of system engineering and integration, business management, operations, customer integration, and accommodation.

Johnson uses all the usual types of information systems support except processing services. Some of the largest purchases documented in NASA's A-11 submission relate to the Mission Operations Directorate, Information Systems Directorate, and Space Station Training Facility.

b. The Ames Research Center (ARC), located at Moffett Field, California, focuses on more arcane areas, including:

- Fundamental aerodynamics
- Rotor craft
- Flight dynamics research
- Guidance control systems
- Computational fluid dynamics research

Ames takes the lead for NASA in computer sciences and computational modeling research, including artificial intelligence. It also actively pursues human factors research, including life support systems, life sciences research, space biological and biomedical research, and man-machine systems.

As does Johnson, Ames uses all the usual types of information support—except for processing services. It spends the bulk of its dollars on professional services, with hardware costs coming in second. According to NASA's FY 1992 A-11 submissions, Ames' largest information technology expenditures will involve the Computer Systems and Research Division and Numerical Aerodynamic Simulation Systems (NAS). Many of the programs described in the A-11s require the purchase of hardware in conjunction with programming and maintenance.

c. The Goddard Space Flight Center (GSFC), located in Greenbelt, Maryland, supports:

- Earth orbital spacecraft development
- Tracking and data acquisition systems
- Spacelab payloads
- Earth dynamics, resources, and communications
- Planetary science research

Goddard's proximity to NASA headquarters in downtown Washington has led to more frequent job transfers between the two sites, resulting in a more agencywide view among Goddard executives.

Unlike the two previous centers, Goddard uses some processing services, although this forms a very small part of the overall information services budget. Goddard spends much effort on software and related services, with heavy effort also on facilities management and hardware. According to INPUT's PAR data base, many of Goddard's future procurements involve hardware and professional services.

The largest programs indicated in the A-11s involve the Customer Data Operations System, Earth Observing System-Data Information System, Mission and Data Operations Testbed Program, Command Management System, and Operations Support Computing Facility System.

d. The Jet Propulsion Laboratory (JPL), in Pasadena, California, functions a bit differently from the other centers. The California Institute of Technology operates the site under contract to NASA. JPL focuses on planetary spacecraft development and mission operations, lunar planetary science, energy technology for space applications, and space astronomy payloads. JPL also performs research on information systems and data acquisition systems technology.

JPL performs limited contracting activity in facilities management and processing services. JPL, as a contracted facility, is not strictly subject to the FIPS PUBs or other government standards. However, where appropriate, it does observe these standards in order to foster compatibility with other NASA centers. Despite its status as a contracted facility, it does submit OMB A-11 budget data for its five-year acquisition plans. INPUT has, therefore, included it in the NASA market forecast. The A-11 shows plans to purchase workstations and superminis.

e. The John F. Kennedy Space Center (KSC), in Florida, designs, constructs, operates, and maintains space vehicle facilities and ground support equipment for launch and recovery operations. Kennedy also recovers and refurbishes the reusable solid rocket booster.

To accomplish its mission, KSC has organized into two operational directorates, one for STS and one for Payloads, plus an Engineering Development Directorate and a Center Support Operations Directorate. The contracting structure at the center is similarly organized into two operational contractors: a Shuttle Processing Contractor (SPC) responsible for

STS processing and launch support and a Payload Ground Operations Contractor (PGOC) responsible for payload processing, including the Space Station Program (SSP). In addition, the Base Operations Contractor (BOC) supports base operations, and the Engineering Support Contractor (ESC) is responsible for technology and engineering laboratory support.

Like other NASA centers, Kennedy contracts little for facilities management and processing services. It also uses comparatively few systems integration contracts, instead relying on internal contractors.

The three largest programs mentioned in the A-11s involve the Payload Data Management System, the Space Station Test System, and the Checkout, Control and Monitor System II.

f. The Langley Research Center (LaRC), in Hampton, Virginia, focuses on various types of aircraft technology; aerospace vehicle acoustics, structures, and materials; space electronics and control systems; and atmospheric sciences. It also engages in computer science research, including fault-tolerant systems.

Unlike most other NASA centers, Langley does use some processing services contracts, although they account for a relatively small part of the overall budget. Also, the A-11 shows a much smaller percentage of buys. The biggest single line item, for mass storage, ranges from $11.9 million in FY 1991 to $11.3 million in FY 1996. Much of this will go to support existing systems.

According to NASA IRM officials, Langley Research Center's main focus for the next five years will be supercomputing and simulation activity.

g. The Lewis Research Center, (LRC), in Cleveland, Ohio, focuses on space propulsion systems, aeroelasticity and structural dynamics, fuels and combustion, engine instrumentation, and engine computational fluid dynamics. It is also concerned with space communication issues.

Like most of the other centers, Lewis does not contract for processing services. However, it does use all the other standard types of contractor support. In addition to supercomputers and traditional mainframes, Lewis uses VAX clusters extensively.

The Lewis OMB A-11 budget shows an extraordinarily high level of purchase plans for hardware. There are also numerous items on data entry equipment, software, and services.

h. The George C. Marshall Space Flight Center (MSFC) operates at the Army's Redstone Arsenal facility in Huntsville, Alabama. It manages, develops, and tests the space shuttle's main engines and associated fuel systems. It also manages both the spacelab and space telescope programs. Marshall supports NASA programs in electronics, guidance, navigation, and control.

Like most of the other centers, Marshall does not contract for processing services. However, it does use all other standard contractor support. Marshall takes advantage of third-party software packages for many mainframe and midsize applications.

Marshall's OMB A-11 budget submission shows an unusually high level of spending for engineering analysis and hardware upgrades. Evidently, consulting also plays a major role at Marshall. For example, one single entry—the Engineering Analysis and Data System (EADS)—shows $45 million in funding for FY 1991. Funding will increase to $63 million in FY 1994.

i. The Stennis Space Center (formerly the National Space Technology Laboratories—NSTL), in Bay St. Louis, Mississippi, plans and manages research and terrestrial applications, as well as space flight. It also performs research in oceanography, meteorology, and environmental sciences. Stennis also coordinates research between NASA and other governmental agencies.

Stennis uses all types of contractor support through its use of facilities management, processing services, and maintenance support. Much of its funding is provided on a cost-reimbursable basis from other NASA Centers and various government agencies. Therefore, some of Stennis's initiatives do not appear in the OMB A-11 budget submission.

Because of NASA's decentralized approach, Stennis Space Center, despite its relatively small size, has sufficient authority to conduct most of its own procurements. This acquisition process forms a major part of the Stennis operation. It has been reported that, because of its Saturn rocket support, the center's need for precision and accuracy has grown sharply. Its computer and telecommunications applications support meteorology, oceanography, archaeology, medicine, and environmental sciences.

Some IRM acquisitions cover general-purpose resources, while others support embedded systems in space and other scientific systems. Most of the acquisitions are mission specific. Therefore, to be successful the vendor must understand the mission objectives of the procurement and be prepared to connect a proposal to it.

3. Information Systems/Acquisition Planning Program

Despite its largely decentralized management and program structure, NASA has implemented and enforces a uniform series of policies on planning. Standard Information Systems Planning (ISP), which supports the budget process, originates at each Center and conforms to standard content and scheduling. Acquisition planning, which supports NASA's procurement process, originates at the proponent program office and also conforms to standard content requirements.

a. Information Systems Planning (ISP)

NASA's ISP program is governed largely by Headquarters Directive NHB 2410.ID, dated April, 1985. Planning begins at each program office, where initiatives are developed and then handed down to the centers for the development of execution plans. Using the initiatives assigned by the Program Offices, each center develops an Information Technology System Plan. These plans are not, for the most part, available to the public. In fact, except in rare circumstances, planning personnel from one Center may not review the plans from other Centers. However, NASA's Information Systems Committee, containing representatives from each Center as well as headquarters and program office personnel, provides mutual assistance in the planning process.

The OMB budget process governs NASA's planning schedule. Exhibit III-4 provides both the traditional and most recent schedule for planning activities at NASA.

EXHIBIT III-4

NASA Planning Schedule

Activity	Traditional Date	Recent Date
HQ Planning Call to Centers	June 1	March 1
Center Plans to HQ	Sept. 15	June 15
Program Office Review	Oct. 15	July 15
IRM Review	Nov. 15	August 15
Comptroller Review, Submit to OMB	Dec. 15	Sept. 15
Budget Mark Received	Feb. 15	

There are two types of plans at NASA:

- Program Operating Plans focus on specific programs, such as the Space Station.
- Institute Operating Plans focus on specific institutions such as the HQ Computer Center.

NASA's annual Information Technology Systems Plan for each center describes the overall planning effort associated with the application of information processing resources to agency activities. Exhibit III-5 summarizes the minimum required contents of each center's plan.

EXHIBIT III-5

NASA Plan Contents

- Acronyms
- Executive summary
- Existing information processing resources posture
  - Information processing resources
  - Existing recurring requirements
  - New requirements
- Significant actions of the past year
- Plan for the current and budget fiscal years
  - Requirements
  - Major actions planned
- Actions proposed and financial data
  - ADP actions list
  - Total obligations and inventory
  - Supporting information
- Long-range planning
  - Requirements
  - Major actions planned for out years
  - Description of issues
  - Long-range ADP funding requirements

This plan format includes typical OMB A-11 data, including the contents of both the A-11 43A and 43B exhibits. In May 1992, NASA plans to publish a combined agencywide five-year IRM plan.

b. Acquisition and Planning

NASA also uses NHB 2410.ID to dictate policy on acquisition planning. At certain thresholds, NASA requires detailed plans in order to ensure that:

- Proper planning for the acquisition action has taken place
- Requirements leading to the acquisition have been reviewed and validated
- Compliance with all applicable directives has been accomplished

NASA's extensive acquisition planning requirements may represent an important marketing opportunity, particularly for small firms located near each center. Those unable to bid on the acquisition itself may assist NASA in developing the planning documentation. Since most buys originate at the centers, the planning documentation is also developed there.

Under certain circumstances the Associate Administrator for Management receives a copy of the acquisition plan. Exhibit III-6 itemizes some of these circumstances. In some cases, approval must be obtained, while in other cases the center need only provide an information copy.

At a minimum, equipment acquisition plans must contain the following elements:

- Analysis of Requirements
- Analysis of Technical Alternatives
- Comparative Cost Analysis
- System Description
- Funding Data
- Schedules
- Acquisition Method
- Security and Privacy Safeguard
- Future Competition
- Long-Range Requirements
- Annual Information Technology Systems Plan Cross-Reference
- Software Conversion Study (when required)
- Federal Information Processing Standards (FIPS) Waivers (when required)

Although acquisition plans for software and services differ slightly in format, they mainly contain the same elements.

EXHIBIT III-6

Involvement by Associate Administrator for Management

	Equipment	Software	Services
Approval	Purchase price exceeds $1,000,000 Annual rental exceeds $300,000	—	—
Information Copy	Sole source exceeds $250,000 Annual rental exceeds $100,000	Competitive— exceeds $1,000,000 Sole source exceeds $100,000 FIPS waiver required	Competitive— exceeds $2,000,000 Sole source exceeds $300,000

This uniformity of planning, for the annual cycle as well as for specific acquisitions, represents a key area of commonality among the centers and across the agency. The decentralized nature of NASA programs can lead to potential miscommunications between centers and program managers. This in turn can lead to inefficiencies in multicenter programs. However, the planning guidelines serve to strengthen intercenter ties and thus reduce disconnects.

B

Information Systems Structure and Functions

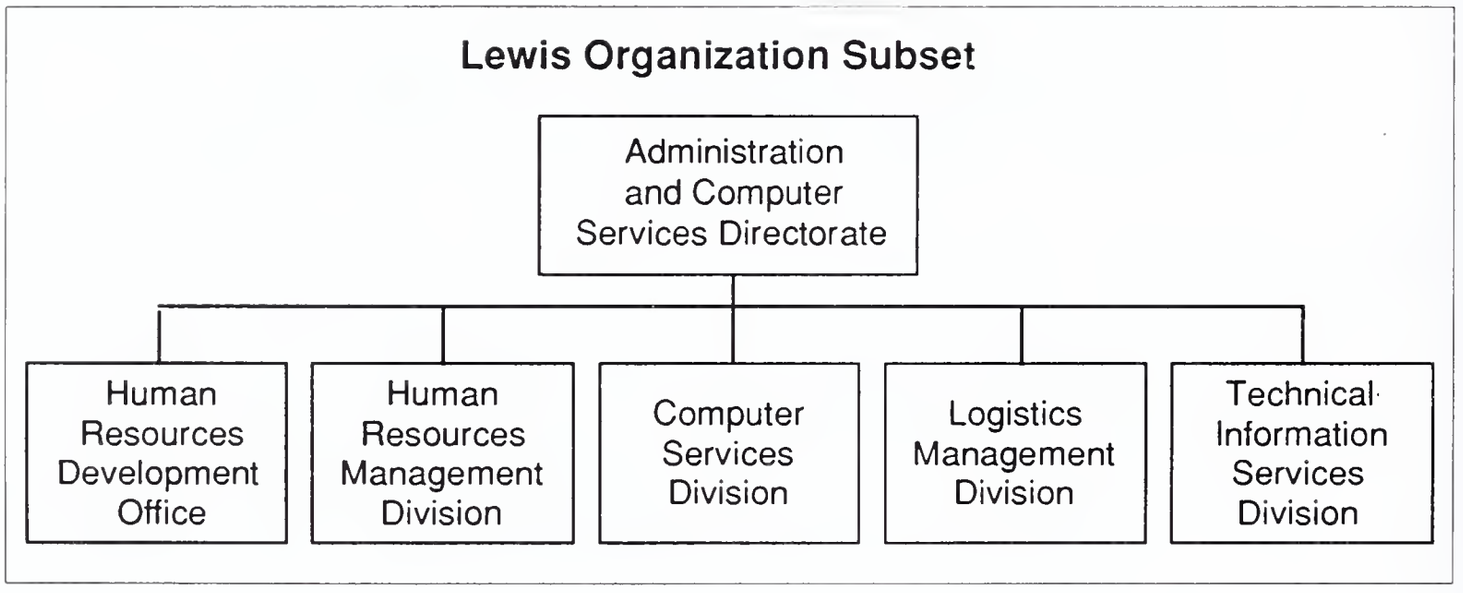
As pointed out in Section A, NASA operates primarily with a decentralized management and program structure, but it is working toward consolidating some IRM procurement efforts. Most ISP originates at the centers and in support of specific programmatic activities. The program drives the decision, and ISP follows that decision. However, since the centers have different functions, they organize their offices—particularly their information systems offices—in widely different fashions. A comparison of two centers, Lewis and Goddard, illustrates this point.

At the Lewis Research Center, the Computer Sciences Division houses most of the typical information systems functions. It contains the following branches:

- User Services
- Scientific Services
- Experimental Data Applications
- Management Information Systems
- Special Projects
- Maintenance and Operations
- Micro/Mini Computer Systems
- Mainframe Systems
- Telecommunications and Networking

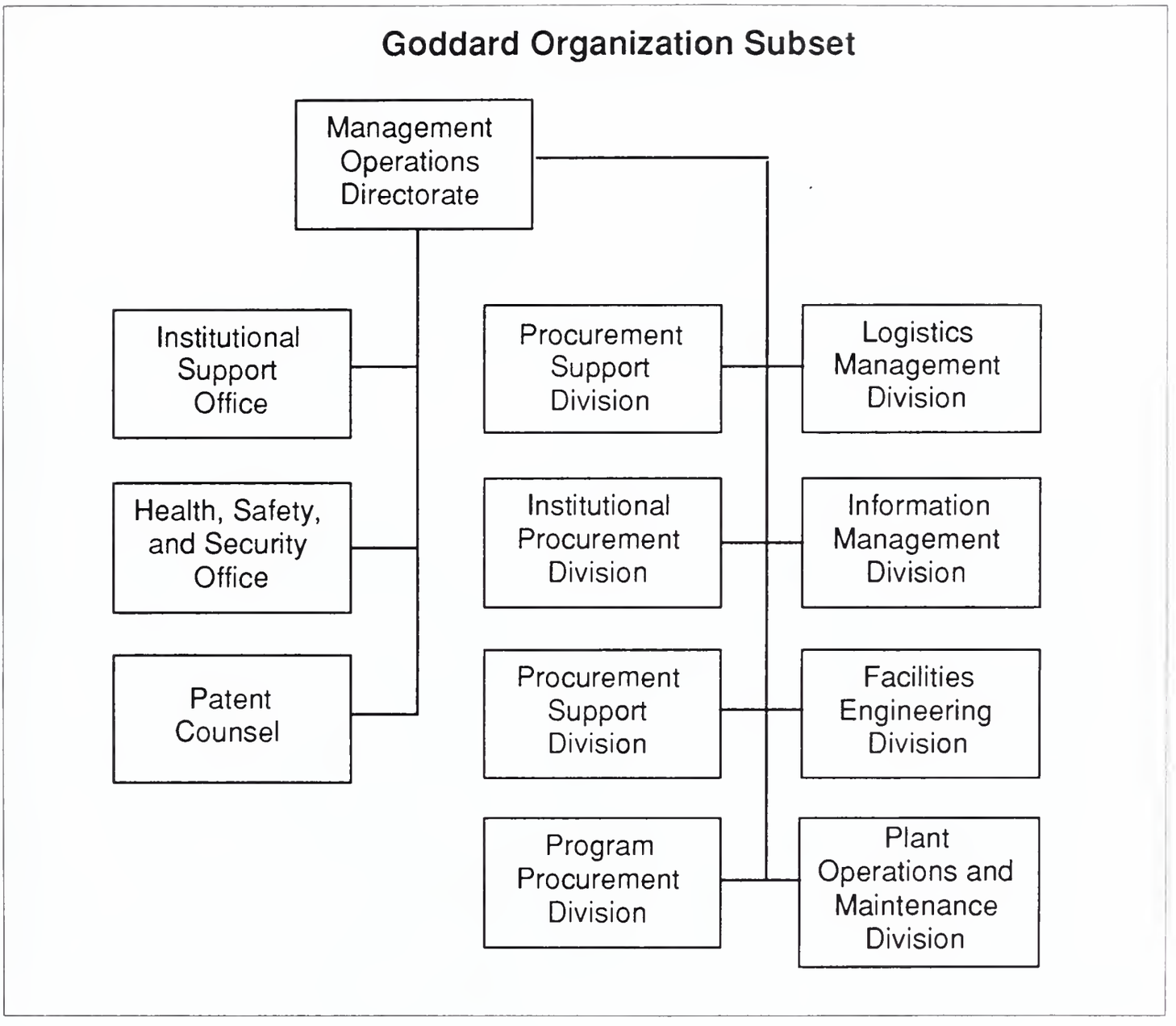
The Chief, Computer Services Division, reports to the Director, Administration and Computer Services Directorate. However, as shown in Exhibit III-7, several apparently unrelated divisions belong to the same directorate.

EXHIBIT III-7



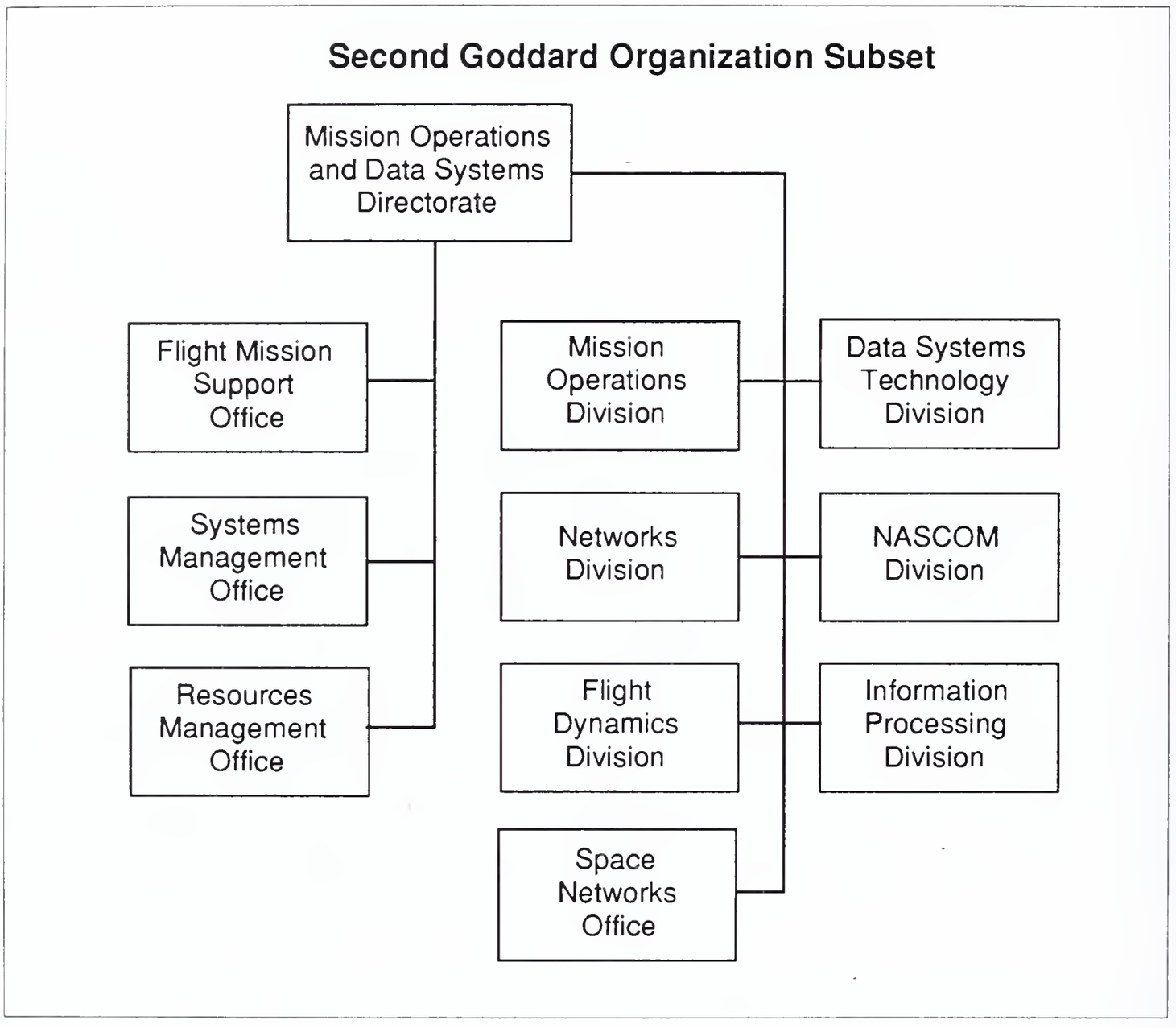
Goddard Space Flight Center uses a somewhat different approach. It contains two information systems organizations supporting different functions. The Management Operations Directorate contains the Information Management Division. It supports mainly the administrative data processing activities at Goddard. Just as is the case at Lewis, the administration directorate at Goddard oversees a wide variety of functions (Exhibit III-8).

EXHIBIT III-8



However, much of Goddard's data processing activities are housed in a separate organization, the Mission Operations and Data Systems Directorate. This directorate provides data processing support to mission-oriented Center programs. Exhibit III-9 shows the office and division breakout for this directorate. In this case, typical IRM functions are scattered across multiple divisions.

EXHIBIT III-9



NASA headquarters functions focus primarily on the four key program administrators, as shown earlier in this section. Each of the four program codes has its own IRM or similar function. The individuals in these positions oversee information systems functions at their subordinate centers.

In addition, NASA headquarters contains three other key offices. The Assistant Associate Administrator for Information Resource Management (Code JT) performs headquarters oversight for all NASA IRM activities. This oversight includes such typical functions as software management, planning, and security, as well as such atypical functions as supercomputing management and records management.

Next, NASA has a headquarters computer operations function that operates in a manner similar to a center office. The Information Technology Division, Code DT, supports headquarters as if it were another center. This code was created in the spring of 1988, as a result of reorganization. Finally, the Inspector General's office, Code W, has taken on an active role in reviewing agency programs. The Assistant Inspector General for Management works closely with headquarters program offices in the review of major information system initiatives.

In terms of acquisition initiatives, the Office of Procurement (Code H) plays a major role. In particular, the Procurement Policy Division (Code HP) submits the Agency Procurement Request (APR) to GSA. This differs from most major departments, in which the central IRM office handles the APRs. Following the delegation, the procurement usually goes back to the initiating center for execution.

C
Information System Trends

Despite its decentralized mode of operation, NASA has taken some steps to bind programs together. Some respondents, at both headquarters and field sites, expressed the need for better information access. NASA is a long way from the vertical and horizontal integration of information, wherein any authorized user can access any information from any terminal. Many agencies have identified this as a goal. Although this higher level of integration may not be appropriate for NASA, some movement to centralized systems is clearly taking place.

NASA's Information Systems Committee, composed of representatives from headquarters, program offices, and from each center, meets twice a year to share data on information systems activities. Each member reviews the activities at the other centers, and then uses these approaches and systems whenever possible.

The Automated Information Management (AIM) Program supports the overall NASA objective of improving the delivery of administrative and management support ADP services. It will provide a mechanism for the identification, evaluation, development, and implementation of agencywide applications. NASA also expects the AIM applications to improve agency productivity. Chapter V discusses the AIM Program in more detail.

In interviews with headquarters executives, INPUT frequently heard of the importance of the Software Support Environment (SSE). Strictly speaking, the SSE will support NASA's overall software architecture for the Space Station Program (SSP). However, several executives now view SSE's usefulness as extending beyond the SSP. The SSE can provide a framework for most major software initiatives in the 1990s. Since several centers are producing software for the SSP, the architecture will fit naturally for many of their systems. NASA headquarters executives hope this program will extend to the remaining centers. This is in keeping with the overall trend toward somewhat less decentralization.

The Program Support Communications Network (PSCN), initiated in April 1985, further supports information sharing at NASA. It consolidates intra-agency program and administrative applications, allowing the elimination of several hundred dedicated and point-to-point circuits between centers. This has led to operating efficiencies and cost benefits through user sharing of transmission trunks and switching equipment. Chapter V contains more specific information on the PSCN.

Other information system trends at NASA relate to its use of state-of-the-art computer technology. Despite NASA's high-tech image, the GAO concluded two years ago that, in some respects, NASA's use of technology had fallen 5 to 15 years behind in computer science and machine intelligence. NASA faces the challenge of balancing the use of new technology with the risk of endangering human life. Since many of NASA's space programs involve operations performed by humans, it is extremely risky to use new, unproven technology. A human manning a space vehicle, for example, could die if the technology failed.

In response to this apparent problem, NASA has initiated wide-ranging efforts in artificial intelligence, leading to growth of its robotics technology development program.

NASA has identified three objectives in its use of automation and robotics for the SSP:

- Reduce the cost of mission control (both ground support and astronaut time spent in housekeeping functions)
- Increase the operational capability of the astronauts by giving them the tools to enable the assembly, servicing, and repair of spacecraft distant from their base vehicle
- Increase the probability of mission success

This illustrates another key trend in information systems at NASA—the technology follows the program. There is little interest in researching artificial intelligence (AI) for its own sake. Rather, AI's ability to influence mission success is the primary concern.

Various bodies, including NASA's Advanced Technology Advisory Committee (ATAC) and Congress' Office of Technology Assessment (OTA) have expressed concerns about the development and implementation of automation and high-quality software. For example, some NASA executives doubt that the SSE will be ready for the initial Space Station design stages. The concern extends to another SSP system, the Technical and Management Information System (TMIS), which is described in Chapter V. TMIS costs could be higher than expected if the system uses off-the-shelf packages that have not been converted to the target language.

In supporting its primary programs, NASA faces a typical quandary. On the one hand, if it uses proven off-the-shelf systems in designing automation support, these systems will likely become obsolete by the time the program comes on line. On the other hand, if it uses state-of-the-art

techniques in designing its information systems, it faces potential schedule delays and cost overruns in critical components. NASA information systems executives need to finesse these competing forces and reach the best available compromise. Similarly, vendors wishing to support NASA programs must bid systems and approaches that take advantage of the latest technology and avoid or minimize the associated risk.

As already discussed above, some concern has been voiced over NASA's use of technology. In the fall of 1987, the National Research Council, an operating agency of the National Academies of Sciences and Engineering, issued a report entitled *Space Technology to Meet Future Needs*. The report criticizes NASA's efforts in developing basic new technologies that will enable future missions to provide the nation with a variety of options for the space program. It recommends that basic research and development be given a higher priority and guaranteed a sufficient budget. This seems highly unlikely, however, given NASA's highly volatile budget environment.

Another force driving technological advances at NASA is the Bush administration's High-Performance Computing and Communication (HPCC) Program. NASA has been involved in the HPCC Program since 1983. HPCC's primary goal is to develop a next-generation supercomputer that is significantly faster than existing supercomputers. A second goal of HPCC is to develop applications and systems software that will let the new machines run at sustained top speed for scientific work. The third HPCC objective is to bring parallel machines into general scientific and engineering use by the middle of the decade. The proposed fiscal 1992 federal budget contains $638 million for HPCC. The other key participants in the HPCC Program are the National Science Foundation, the Defense Advanced Research Projects Agency (DARPA), and the Department of Energy.

A subsequent chapter of this report, the market forecast, provides additional discussion on information system trends at NASA.

D
Procurement Trends

NASA's IT contracts grew from $594 million in FY 1989 to $700 million in FY 1990. This represents an 18% increase from FY 1989. Exhibit III-10 shows the obligated contract amounts by individual IT market segment for both fiscal years.

The largest obligation amount for IT in FY 1990 was the ADP and Telecommunications Services ($159 million). This may reflect the need for professional services to support the complex scientific systems present throughout NASA.

As NASA's programs advance and technology increases, more manpower is needed to operate, engineer, design, and redesign systems to meet program needs.

EXHIBIT III-10

NASA IT Contract Awards—FY 1989-FY 1990

	FY 1989 ($000s)	FY 1990 ($000s)
ADP Services		
• ADP and telecommunications services	144,341	159,355
• Systems development, analysis, programming	40,339	109,811
• Facilities management	84,577	93,392
ADP Equipment-Related Services		
• Maintenance, repair, and rebuilding of equipment	10,110	10,832
• Modification of equipment	0	49
• Technical representative services	3,433	0
ADP Equipment		
• ADP equipment and support equipment	131,534	151,716
• Prepackaged software	8,189	10,852
Telecommunications Equipment		
• Communications, detection, and coherent radiation equipment	6,221	3,821
• Fiber optic materials, comps, assemblies	641	720
• Telephone and facsimile	12,302	9,874
Telecommunications Equipment-Related Services		
• Maintenance, repair and rebuilding of equipment	10,718	10,152
• Modification of equipment	3	0
• Installation of equipment	5,280	6,349
• Technical representative services	0	1,460
Leased Telecommunications Services		
• Leased telecommunications services	136,158	131,967
Total	593,846	700,350

Source: Pinpoint

Exhibit III-11 shows NASA's IT A-11 budget submissions to OMB for FY 1992. *Note that the FY 1990 number is actual, the FY 1991 number is estimated, and the FY 1992 number is forecast.* The FY 1990 IT figure on the NASA budget submissions is significantly higher than the cited IT contract obligations for the same fiscal year. The difference in FY 1990 total obligations shown in Exhibits III-10 and III-11 may be explained by the varying definitions of IT. INPUT chose FY 1990 contract awards for ADP services, ADP equipment, and telecommunications equipment and services to compute Exhibit III-10. Exhibit III-11 is drawn directly from NASA's A-11 submissions, which give no detailed definitions of the expenditure categories. It is suspected that the A-11 submissions contain funding for R&D activities or other professional services not included in the contract awards chosen for Exhibit III-10.

EXHIBIT III-11

NASA IT Budget Submissions—FY 1990-FY 1992

	FY 1990 ($000s)	FY 1991 ($000s)	FY 1992 ($000s)
Capital Investments			
• Purchase of hardware	341,311	374,919	459,008
• Purchase of software or other equipment	54,515	71,115	99,509
Equipment Rental, Space, and Other Operating Costs			
• Leased hardware	72,957	62,846	70,227
• Leased software	21,095	21,672	22,078
Commercial Services			
• ADPE time	20,327	21,191	22,496
• Voice communications	15,997	17,137	17,065
• Data communications	49,843	61,511	80,564
• Operations and maintenance	342,931	382,672	417,838
• Systems analysis, programming, design, and other	460,052	509,890	578,216
Total Obligations to be Contracted	1,379,028	1,522,953	1,767,001

Note: This exhibit only includes IT to be contracted out.

Source: NASA's FY 1992 A-11 submissions to OMB

According to NASA's FY 1992 A-11 submissions, the total IT obligation to be contracted will grow 16%, from $1.5 billion in FY 1991 to $1.8 billion in FY 1992. The most growth is expected in funding for the purchase of hardware, systems analysis, programming, and design. This funding will include programs such as Goddard's $100 million "Mass Buy for Technical and Scientific Workstations" and Ames' $20 million "Testbed I Computer Systems."

Exhibit III-12 lists the top NASA IT contractors ranked by FY 1990 contract award amounts. The exhibit breaks the IT market into three segments: ADP services, ADP equipment, and telecommunications equipment and services.

EXHIBIT III-12

Top NASA Contractors—FY 1990

	FY 1990 Awards ($000s)
ADP Services	
• CSC	79,764
• Boeing	71,971
• Loral	67,633
• Sterling Software	47,228
• Grumman	17,284
ADP Equipment	
• Cray Research	42,398
• Silicon Graphics	15,090
• Digital Equipment Corporation	12,825
• Honeywell	10,964
• Grumman	10,572
Telecommunications	
• Boeing	92,645
• General Electric	15,176
• IBM	14,589
• AT&T	7,555
• Contel	4,651

Source: Pinpoint

CSC ranked highest for ADP services contracts in FY 1990. This includes contracts such as the $65.7 million engineering support services contract from Goddard Space Flight Center awarded to CSC in April 1990. Boeing ranks second for ADP services contracts, which include its "Technical and Management Information System" (TMIS) contract for NASA's Space Station Freedom.

Cray Research, Inc. ranks first among NASA ADP equipment contractors. This is due to the large volume of Cray supercomputer purchases made by NASA centers. Silicon Graphics, Inc. ranks second with its high-powered graphics workstations capable of handling large amounts of complex data. In September 1990, NASA awarded a $33 million contract to Silicon Graphics for computer equipment to be supplied to Ames' Numerical Aerodynamic Simulation Processing System Network (NPSN) facility.

Boeing ranks first among NASA telecommunications equipment and service providers. Much of Boeing's NASA business comes from its work on NASA's Program Support Communications Network (PSCN). PSCN is operated out of Marshall Space Flight Center and links 17 NASA centers and 100,000 users nationwide.

The majority of NASA's purchases and contracts are made by the procurement offices of its field installations. Exhibit III-13 shows the top contractors for each IT market segment at each of NASA's centers.

EXHIBIT III-13

NASA Field Installations' Top IT Vendors—FY 1990

Installation	Vendor	$000s
Ames Research Center		
• ADP services	Atlis Federal Services	17,438
• ADP equipment	Cray Research	21,442
• Telecommunications equipment and services	Taft Broadcasting	2,199
Total IT Obligations		122,983
Goddard		
• ADP services	Computer Based Systems	5,547
• ADP equipment	Cray Research	5,347
• Telecommunications equipment and services	Myko Enterprises	1,972
Total IT Obligations		42,843
Jet Propulsion Lab		
• ADP services	*	
• ADP equipment	*	
• Telecommunications equipment and services	*	
Total IT Obligations		
Johnson Space Center		
• ADP services	Ford Aerospace	67,633
• ADP equipment	Grumman Aerospace	10,572
• Telecommunications equipment and services	IBM	10,323
Total IT Obligations		169,820
Kennedy Space Center		
• ADP services	Honeywell	6,576
• ADP equipment	Honeywell	10,943
• Telecommunications equipment and services	Ampex	752
Total IT Obligations		23,754

*No contract awards identified in this category.

EXHIBIT III-13 (CONT.)

NASA Field Installations' Top IT Vendors—FY 1990

Installation	Vendor	$000s
Langley Research Center		
• ADP services	Unisys	6,887
• ADP equipment	Cray Research	11,838
• Telecommunications equipment and services	IBM	4,266
Total IT Obligations		41,068
Lewis Research Center		
• ADP services	IBM	2,022
• ADP equipment	EDS	6,703
• Telecommunications equipment and services	Federal Business Systems	1,384
Total IT Obligations		31,094
Marshall Space Flight Center		
• ADP services	Boeing	71,971
• ADP equipment	Intergraph	4,089
• Telecommunications equipment and services	*	
Total IT Obligations		108,462
Stennis Space Center		
• ADP services	Hilton Systems	2,007
• ADP equipment	NEC	138
• Telecommunications equipment and services	South Central Bell	2,620
Total IT Obligations		5,340

*No contract awards identified in this category.

Cray Research, Inc., as anticipated, appears as the top ADP equipment contractor for Ames, Goddard, and Langley. As mentioned earlier, this is due to Cray's large volume of supercomputer sales to the centers.

The Jet Propulsion Lab (JPL) showed no contract awards for FY 1990 in the market segments listed. This may result from its unusual status as a contractor facility.

Ford Aerospace appears as the top contractor for Johnson Space Center for ADP services. Ford is responsible for the installation and maintenance of networks linking mainframes at JSC.

Unisys ranks first at Langley Research Center for ADP services. Unisys contract awards at Langley include a $20 million contract for data center management and integration services awarded in August 1990.

Boeing shows the largest value of contract awards for FY 1990. It was the number-one contractor at Marshall Space Flight Center for ADP services during that time period. As previously mentioned, most of this funding is for the Program Support Communications Network (PSCN).

It may appear unusual that CSC does not show up as a top contractor for any of the centers in Exhibit III-13. In Exhibit III-12 CSC shows the largest amount of contract awards for FY 1990.

The reason for this discrepancy is that CSC is ranked as the second top contractor at Johnson, Goddard, and Kennedy in the ADP services area.

Exhibits III-12 and III-13 suggest that the most lucrative contracts at NASA are those for ADP services. As defined by INPUT, ADP services include system design, CAD/CAM, data conversion, data entry, network management, programming, system analysis, systems development, or facilities management.

These findings may imply that, even though NASA performs large amounts of systems integration with its in-house staff rather than contractors, it employs contractors to operate, maintain, and assist in systems development. NASA still purchases systems components and performs many services in-house, but the amount of ADP services procured by NASA is increasing as its programs advance and become more complex.

IV

NASA Market Forecast

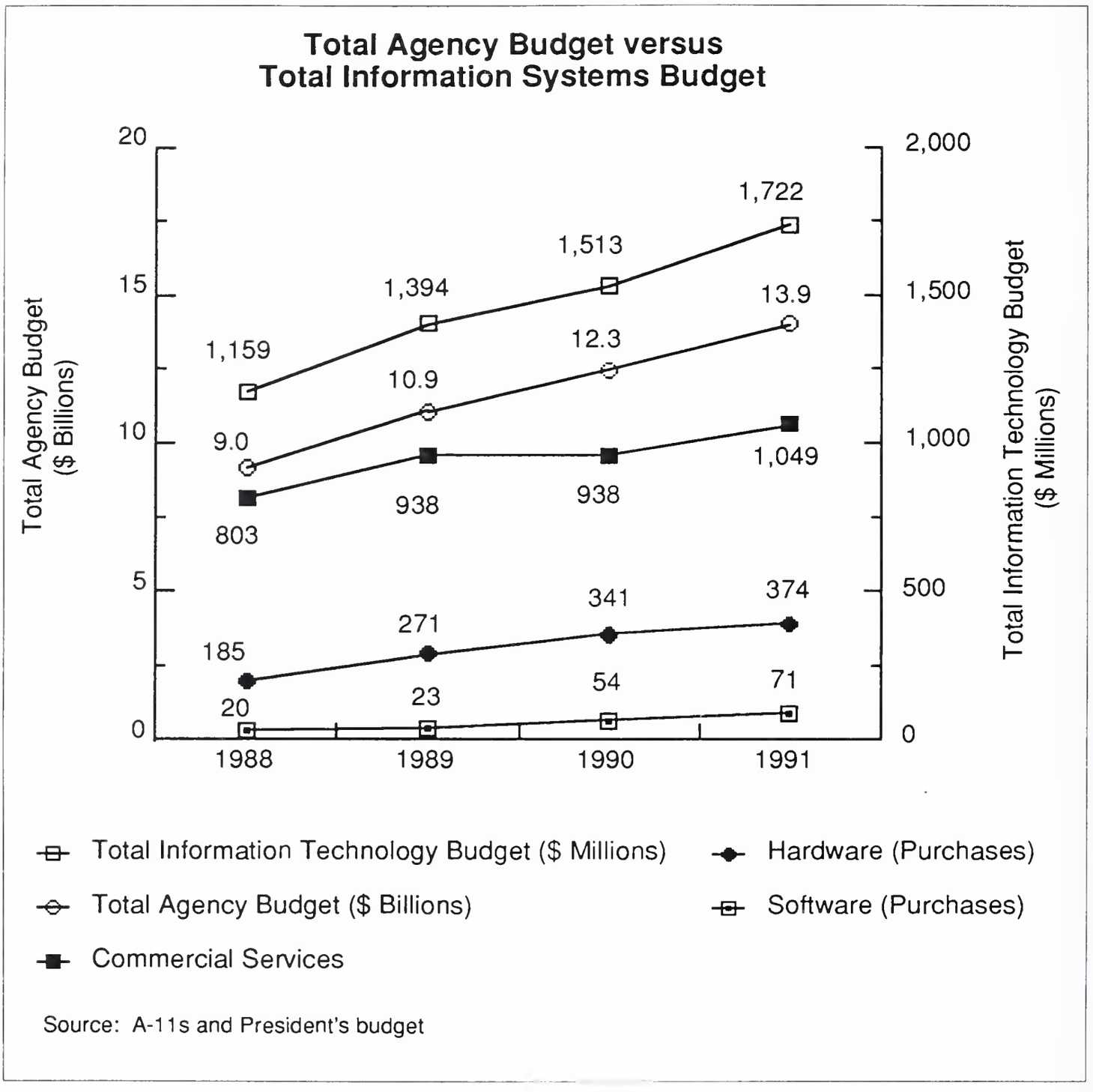
A

Past and Current Funding Patterns

In determining future information technology funding, it is useful to examine past funding patterns. Exhibit IV-1, developed by INPUT, shows total agency and information funding for the past four years. As is apparent, the information technology curve grows more steeply than the overall budget curve. This indicates that information technology has taken a steadily larger portion of the agency budget.

Exhibit IV-2, also developed by INPUT, supports this finding. In FY 1992, slightly more than half of NASA's information technology budget is set aside for services. Although NASA categorizes things somewhat differently than INPUT, the percentages shown represent a useful perspective of NASA's budget. INPUT's overall forecast, shown in Exhibit IV-4, depicts a somewhat smaller contracted budget base for FY 1991 than this exhibit shows for FY 1992. This comes from the fact that the overall agency budget has sharply increased, with information technology taking a bigger portion.

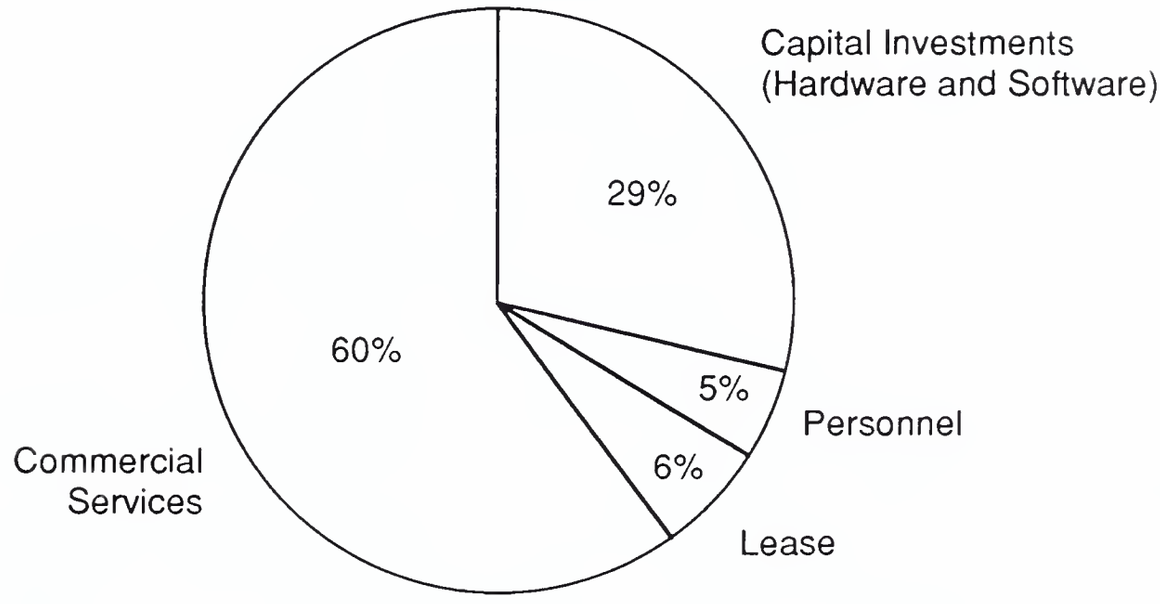
EXHIBIT IV-1



Source: A-11s and President's budget

EXHIBIT IV-2

NASA Information Technology Funding by Major Functional Areas—FY 1992

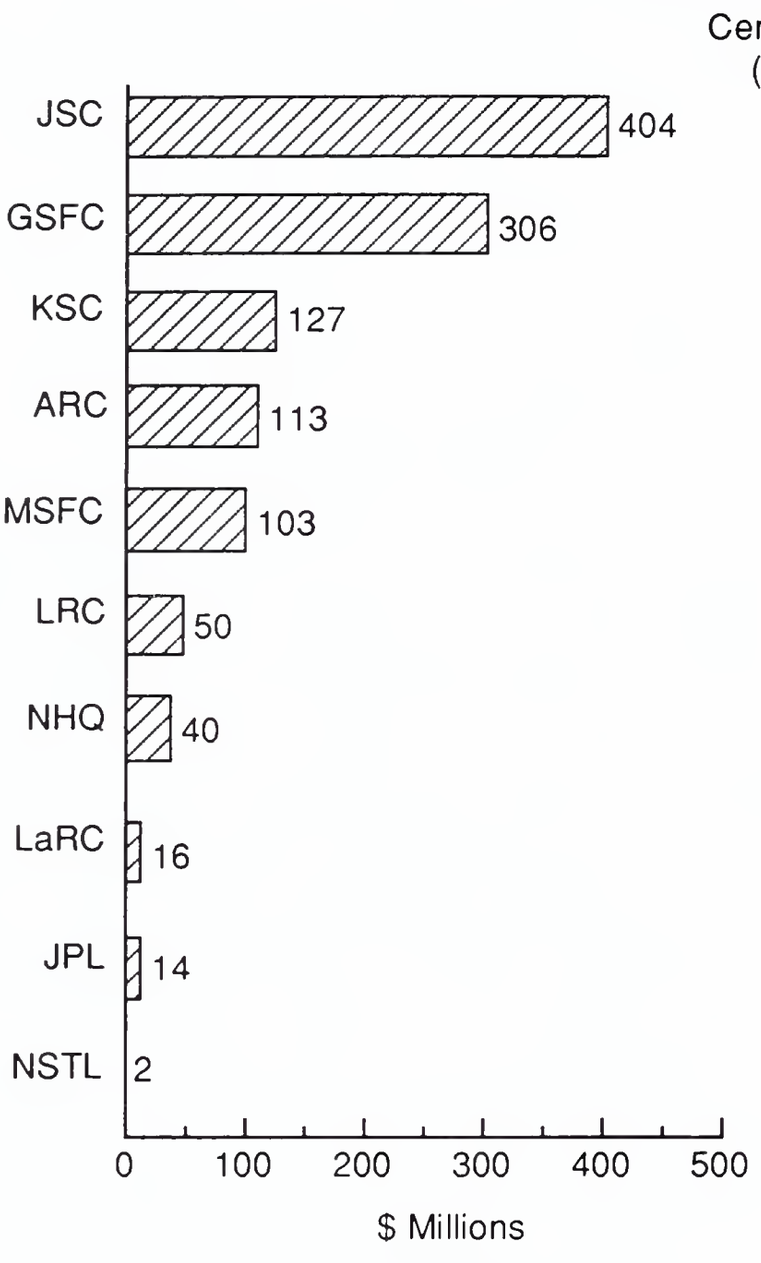


FY 1992 total funding obligations = $1.97 billion

Source: NASA's FY 1992 A-11 budget submissions

Exhibit IV-3 shows NASA centers' total information technology line-item funding. The exhibit was derived from NASA's FY 1992 A-11 budget submissions to OMB. NASA's total FY 1992 information technology obligations equal $1.97 billion, with $1.2 billion of these obligations from the center's line items. Johnson Space Center's initiatives account for 34% of the total funding. This is due to the Space Station Program managed by Johnson. Goddard is second, with 26% of the funding. The Earth Observation System (EOS) demands a large portion of this funding. With both of these programs in early stages of development, INPUT expects Johnson and Goddard to maintain high percentages of NASA's overall budget in the next five years.

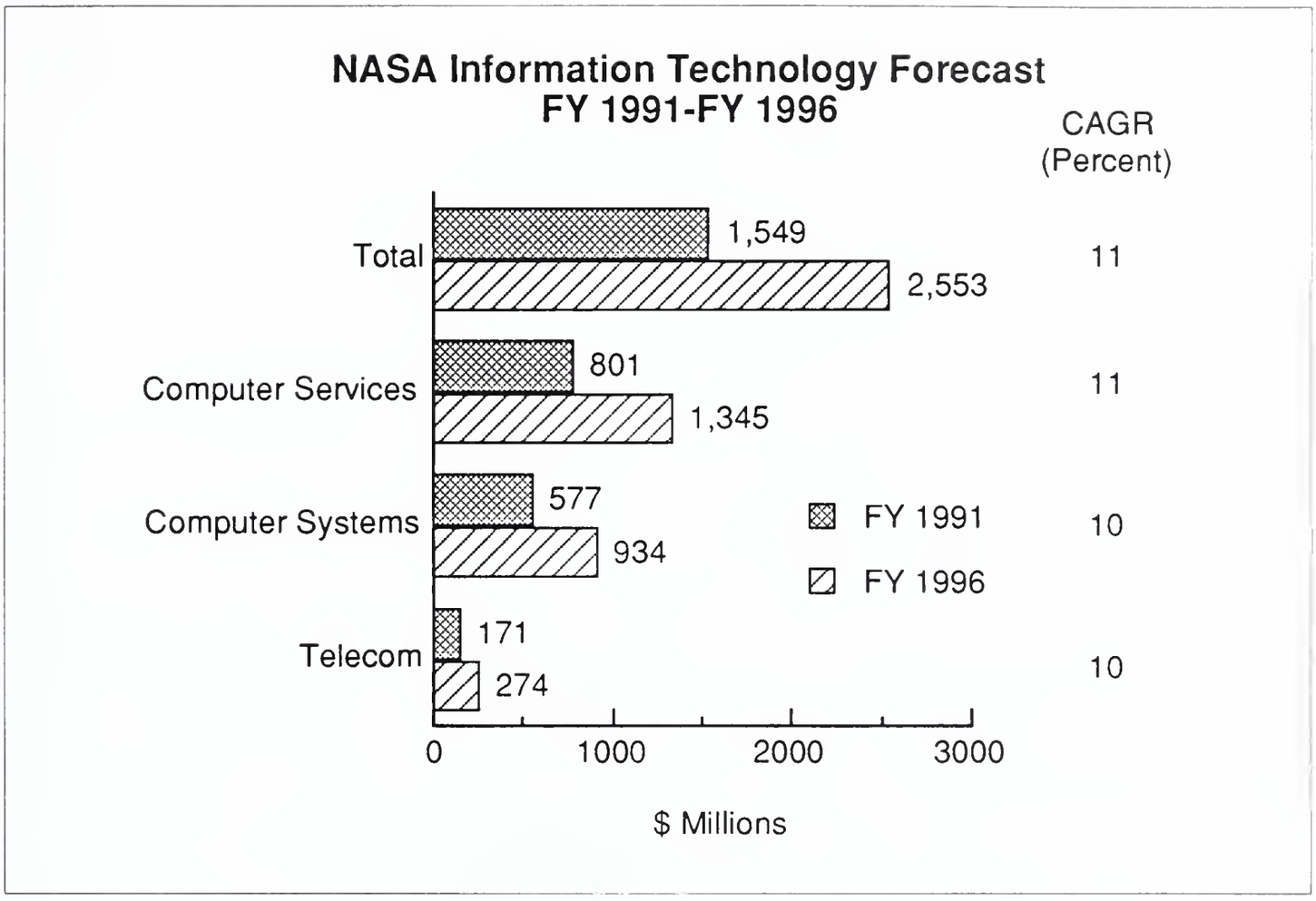
EXHIBIT IV-3



Source: NASA's FY 1992 A-11 budget submissions

INPUT estimates that the contracted portion of NASA's information systems budget will grow from $1.5 billion to $2.6 billion, as shown in Exhibit IV-4. Section B contains a detailed breakout of this forecast.

EXHIBIT IV-4



B

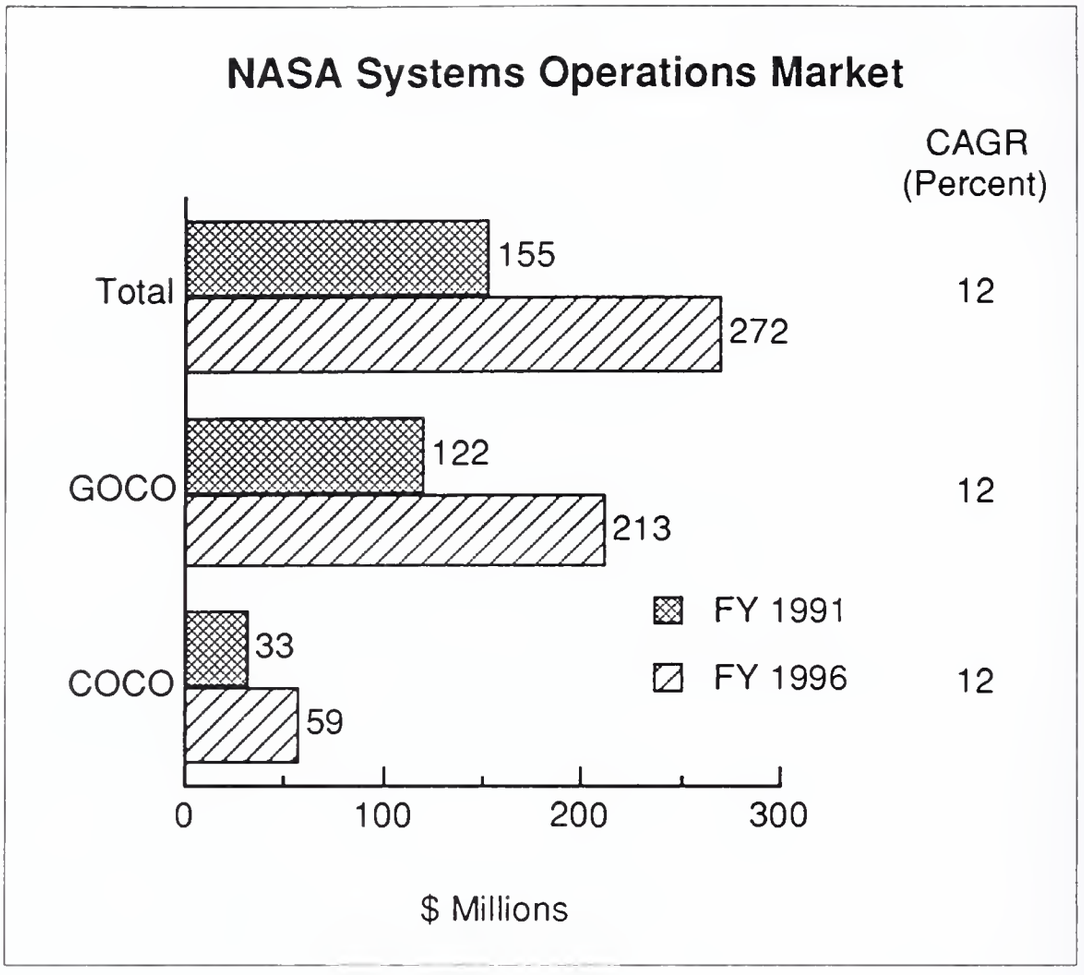
Market Segment Forecasts

Based on NASA's A-11 budget submissions, individual center plans, and interviews, INPUT has developed segment forecasts for NASA. This section covers those segments.

1. Systems Operations

Exhibit IV-5 shows that the NASA systems operations market will grow from $155 million in 1991 to $272 million in 1996. This represents a CAGR of 12%. In this case, both the contractor owned, contractor operated (COCO) portion and the government owned, contractor operated (GOCO) portion will grow at 12%. However, COCO represents only about a quarter of the total market. Unlike most agencies, NASA has a long tradition of using vendors to operate its data centers.

EXHIBIT IV-5



2. Telecommunications

Exhibit IV-6 shows that the NASA telecommunications market will grow from $171 million in 1991 to $274 million in 1996. This represents a CAGR of 10%, which coincides directly with INPUT's forecast for the government as a whole. INPUT's earlier forecast for NASA showed a lower growth rate. However, with the planned growth of intercenter resource sharing partly enacted, this growth rate increased sharply. The telecommunications market includes professional services, hardware, network services, and leased telecommunications (both networks and transmission facilities).

3. Software Products

Exhibit IV-7 shows that the NASA software products market will grow from $97 million in 1991 to $201 million in 1996. This represents a CAGR of 16%, which exceeds INPUT's overall government forecast of 12% in this segment. NASA's 43A submissions for the last few years provided the key source for this forecast, and these numbers have exceeded governmentwide growth. This may reflect a greater willingness on NASA's part to accept the products developed by others and implement them in NASA systems.

EXHIBIT IV-6

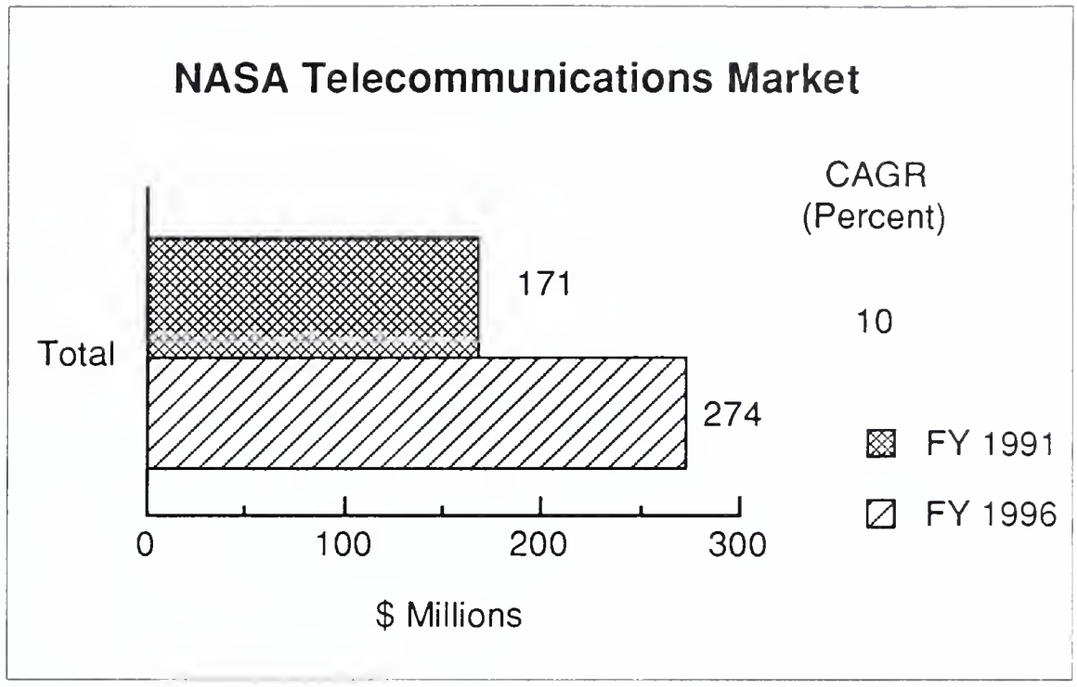
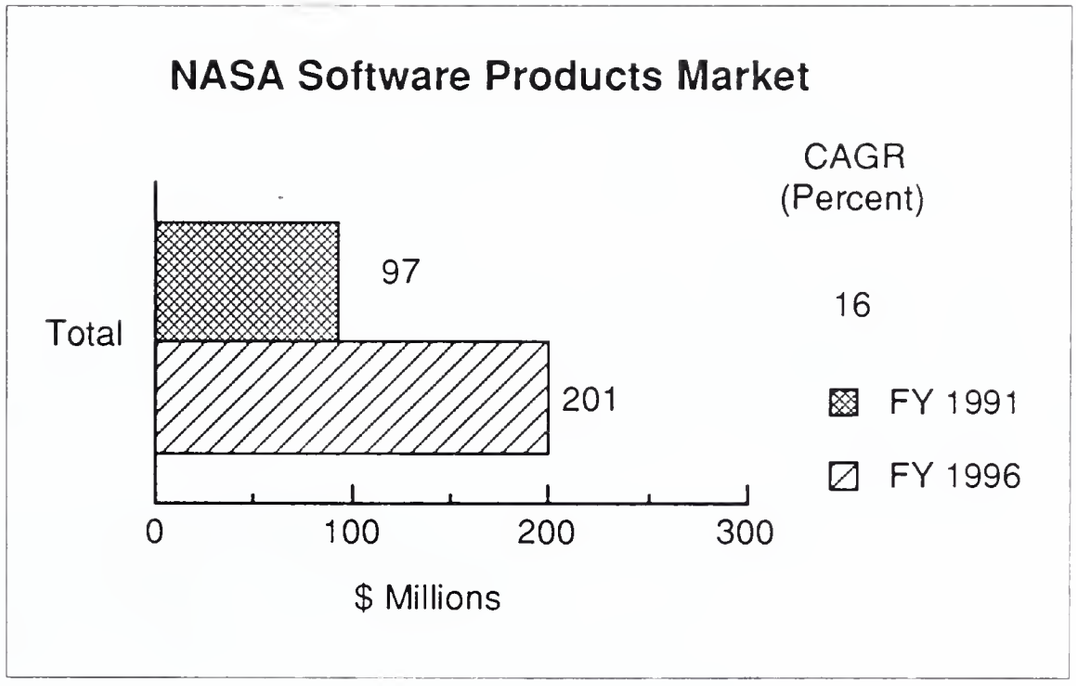


EXHIBIT IV-7

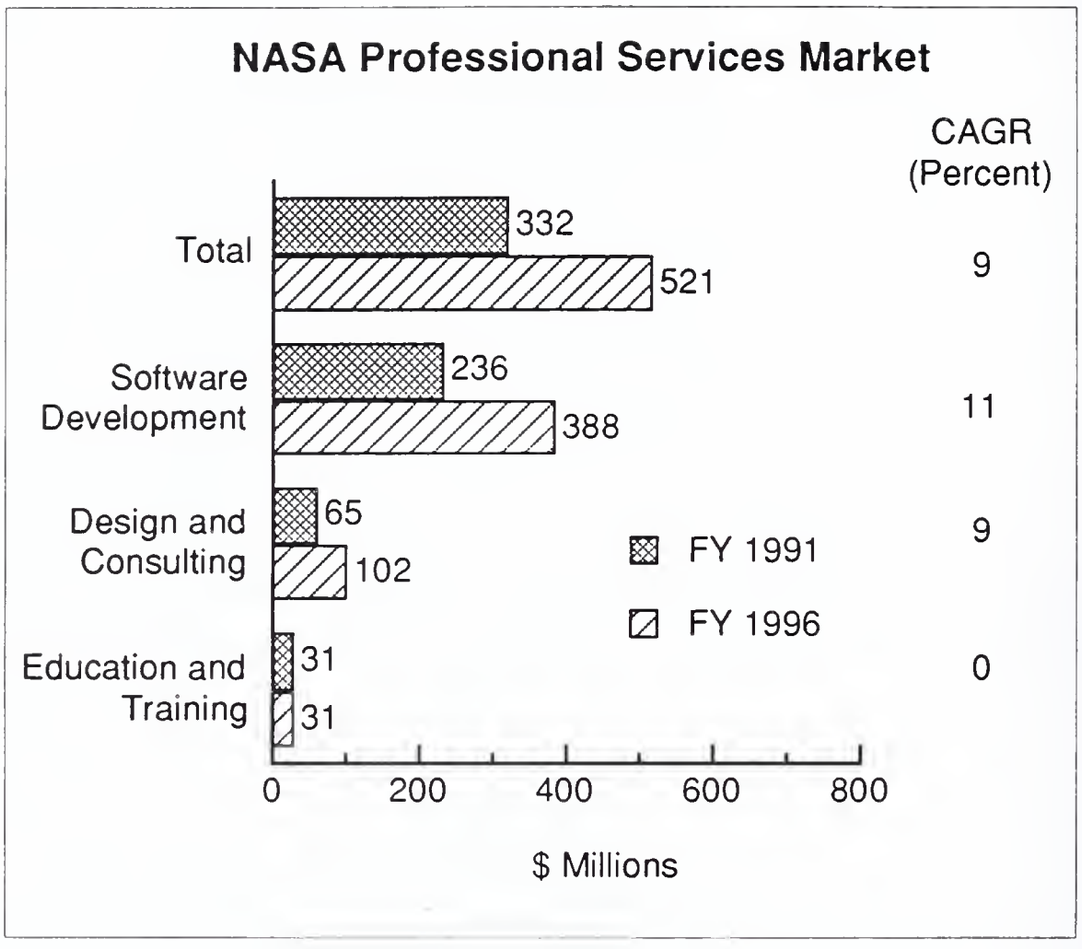


4. Professional Services

Exhibit IV-8 shows that the NASA professional services market will grow from $332 million in 1991 to $521 million in 1996. This represents a CAGR of 9%, similar to the growth rate that INPUT predicts for the government as a whole. This relatively low growth rate stems largely from NASA's relatively larger starting base. However, NASA's growth in the facilities management portion of professional services, as well as

education and training, is larger than the overall government growth. It also presents a picture consistent with NASA's rising acceptance of software products. This trend has constrained NASA's need for custom software development.

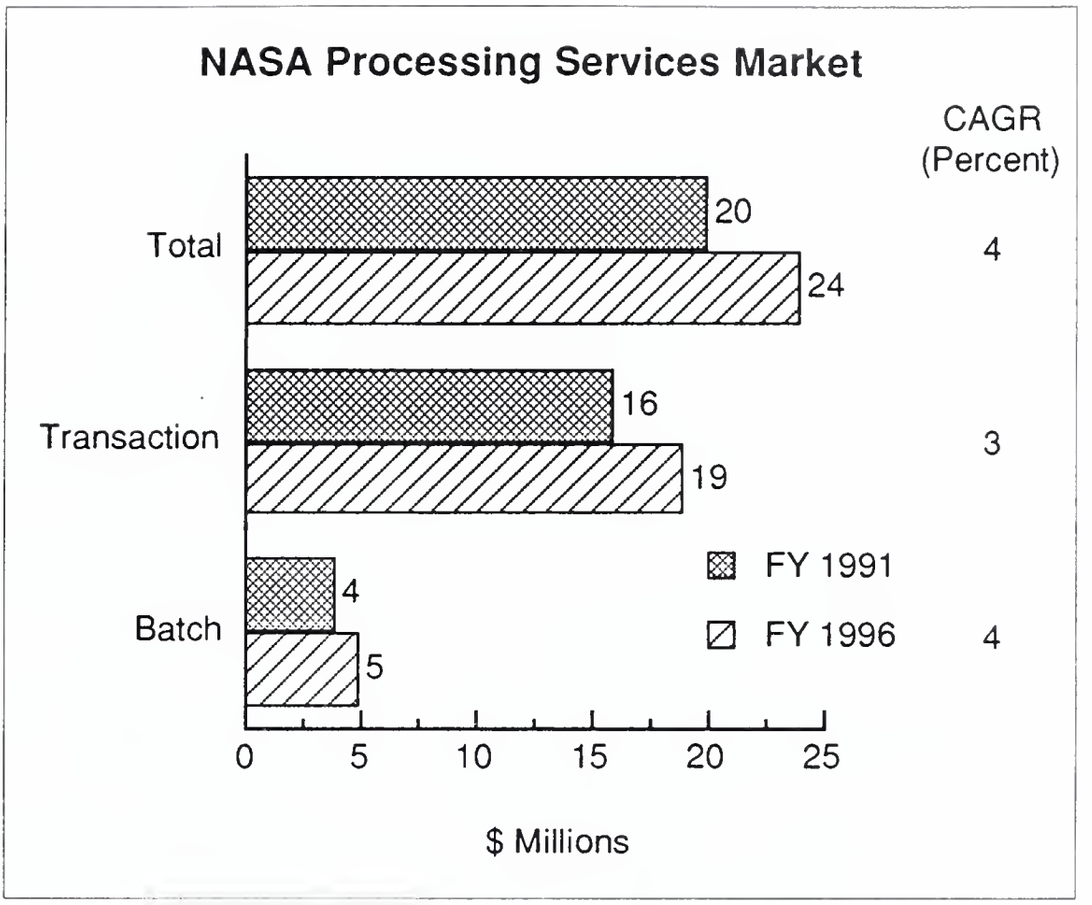
EXHIBIT IV-8



5. Processing Services

Exhibit IV-9 shows that the NASA processing services market will grow from $20 million in 1991 to $24 million in 1996. This represents a CAGR of 4%, which significantly exceeds INPUT's forecast for the government as a whole. INPUT recommends that, without existing contracts, most vendors ignore this market. It is nearly flat, and not really large enough to merit serious attention.

EXHIBIT IV-9

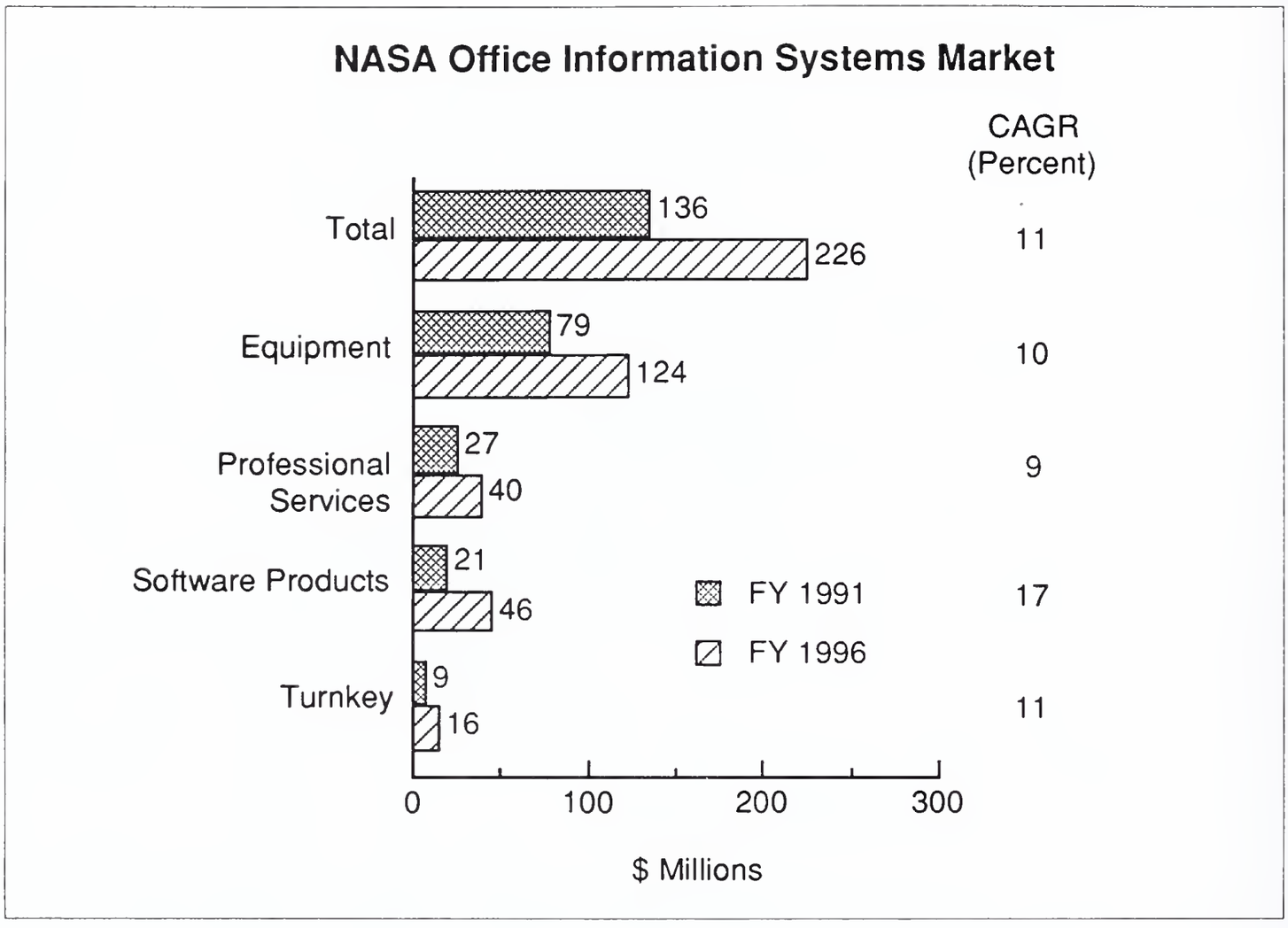


6. Office Information Systems

Exhibit IV-10 shows that the NASA office information systems market will grow from $136 million in 1991 to $226 million in 1996. This represents a CAGR of 11%, which exceeds INPUT's total federal forecast of 10%.

In INPUT's earlier report, NASA's OIS market growth lagged behind overall growth. This shift indicates significant changes in spending on office systems at NASA.

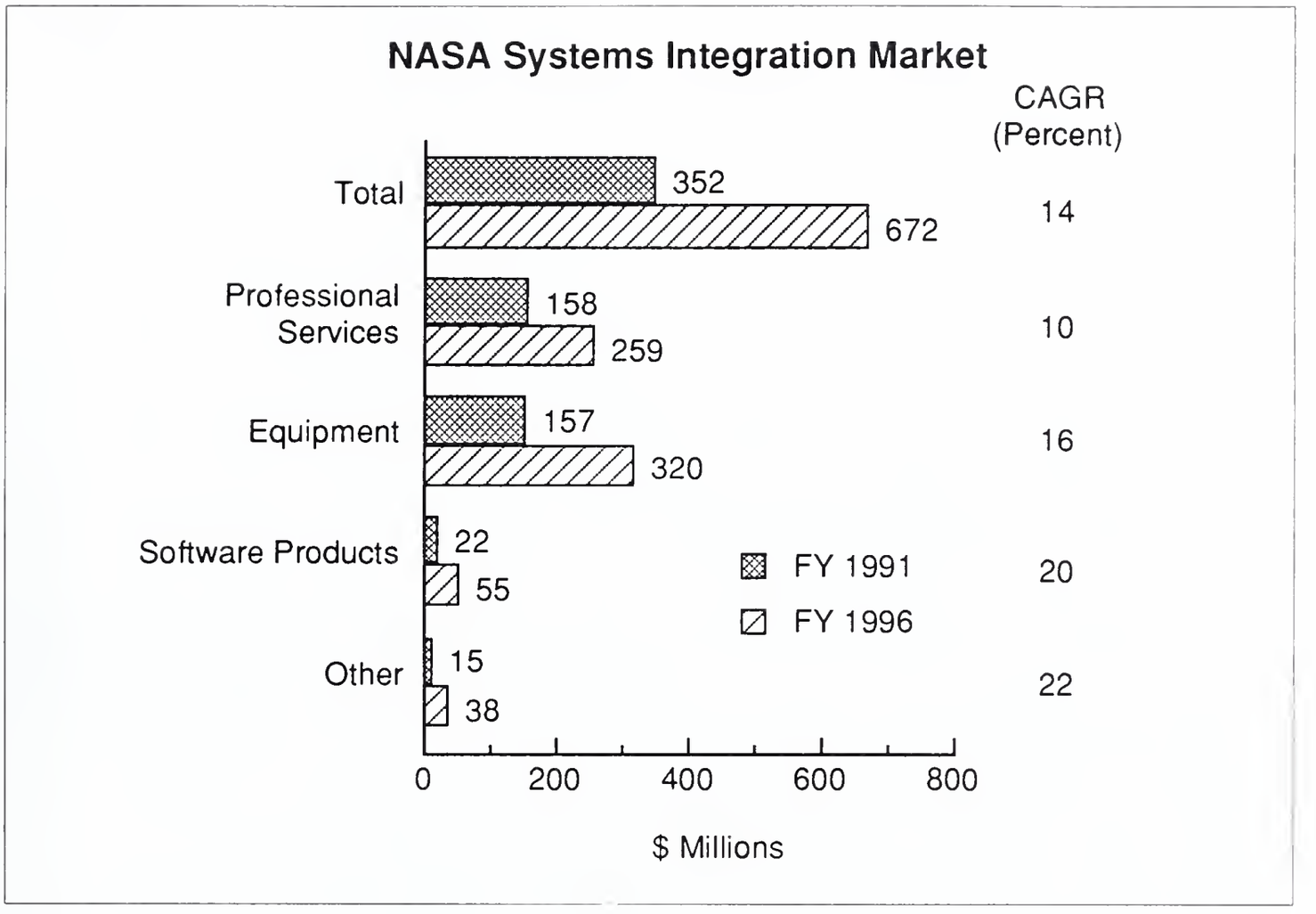
EXHIBIT IV-10

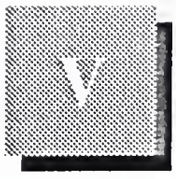


7. Systems Integration

Exhibit IV-11 shows that the NASA systems integration market will grow from $352 million in 1991 to $672 million in 1996. This represents a CAGR of 14%, again lagging behind the 16% overall government rate. Just as in other segments, the professional services portion of NASA system integration was lower than that for the government as a whole, 10% to 16%. NASA continues to present numerous opportunities for qualified integrators.

EXHIBIT IV-11





Major Information System Acquisition Plans

As might be expected in any decentralized organization, NASA has identified a wide variety of information system acquisitions. Some of these will help to bring information processes together. The AIM program, for example, discussed in an earlier chapter, will enhance information sharing. However, most systems remain relatively independent and self-contained. This section discusses some of the key strategies.

A Space Station

According to NASA IRM executives, the Space Station Program (SSP) is one of the dominant NASA initiatives for the 1990s. Since the information systems follow the programs, it is to be expected that the systems supporting the SSP will dominate. This section discusses some of the major SSP information systems. The SSP may also be referred to as the Space Station Freedom Program.

The SSP is a three-phased development project to place a permanently manned space station and associated free-flying platforms in a stable orbit. Phase A consisted of a collection of feasibility studies; Phase B involved concept definition studies; and Phase CD, currently under way, consists of the actual design, development, and deployment of the space station. Phases A and B are complete. Prime contractors for Phase CD have been chosen.

Phase CD is divided into four work packages. Work Package I is being conducted from Marshall Space Flight Center. The primary element involves the development of the habitation module (living quarters). Additional responsibilities include the development of a logistics module and a laboratory module oriented for research in materials processing technology. It also includes the development of environmental control, life support systems, and the propulsion system. The prime contractor for Work Package I is Boeing Aerospace.

Work Package II is being conducted at Johnson Space Center. The primary responsibility of Work Package II is the overall structure, assembly, and framework of the space station. Additional responsibilities include the development of the following subsystems: data management, communications and tracking, orbital interface subsystems, EVA (Extra Vehicular Activity) suites, and man-maneuvering units. The prime contractor for Work Package II is McDonnell Douglas.

Work Package III is being conducted at Goddard Space Flight Center. The primary responsibility of Work Package III is the polar orbiting platform, which is a separate spacecraft. Additional responsibilities include the attached payload accommodations on the space station, and the flight telerobotic servicer. The primary contractor for Work Package III is General Electric.

Work Package IV is being conducted at Lewis Research Center. The responsibility of Work Package IV is the development of the electrical power supply system and all directly related subsystems. The prime contractor for this work package is Rocketdyne.

The preliminary requirements review was completed in the summer of 1988. At this writing, the program is undergoing preliminary design review. The critical design review of the capability (habitation) will occur around the beginning of calendar year 1993. The first element launch is timed for November 1995, and permanently manned capability is scheduled for approximately September 1999.

NASA held a press conference on the SSP in December 1991. The SSP was criticized by Congress throughout the 1980s as being too expensive. SSP underwent many budget fights and revisions. NASA believes the $40 billion program is now on track again.

SSP is one of the most complex international technology projects ever attempted. Sources on Capitol Hill believe it is still likely to face an annual budget struggle.

After years of turmoil and complaints of runaway engineering, the space station design has been slimmed down and simplified, cutting $6 billion off its price over the next six years.

According to the Program Office, no other government RFPs are expected for direct support of this program. Vendors interested in subcontracting opportunities should contact the prime contractors for the work packages. At this writing, representatives from each prime contractor state that no information technology related requirements exist at this time. However, future subcontracting opportunities may arise as the program progresses. Also, opportunities exist for systems indirectly supporting the SSP effort.

The SSP is funded through a variety of NASA programs. Other line items listed in NASA's A-11 budget submissions that contain SSP funding are as follows:

- Space Station Support Systems
- Space Station Training Facility
- Space Station Control Center
- Space Station Project Office Data Support System
- Space Station Test Control and Monitoring System

1. Technical and Management Information System (TMIS)

NASA is currently implementing a Technical and Management Information System (TMIS) for the purpose of providing the necessary collection, dissemination, and processing of data to manage the Space Station Program. The system will establish a communications network and data base to link together the NASA centers, their contractors, and international partners. TMIS will be a planning and managerial tool for the Space Station Definition and Preliminary Design Program, which will be incrementally upgraded over the ten-year contract life.

TMIS will provide all computational resources needed to fulfill the requirements for the development of the Space Station Definition and Preliminary Design Program. In addition, TMIS will establish the technical data base and the common user data management system required for the Space Station Program. TMIS will serve as a distribution vehicle that will assist in the technical and programmatic coordination among the Space Centers working on development of the space station.

The planned capabilities of the system include:

- The capability to exchange technical and management information (for example, drawings and budgets) between all Space Station participants, including NASA centers and contractor locations

- Sixteen data processing capabilities (for example, word processing and computer-aided design) in support of 28 program functions such as project management, technical analysis, and Space Station operations

- The capability to archive and store program information throughout the station's operational life

The TMIS contract was awarded to Boeing Computer Services in June, 1987.

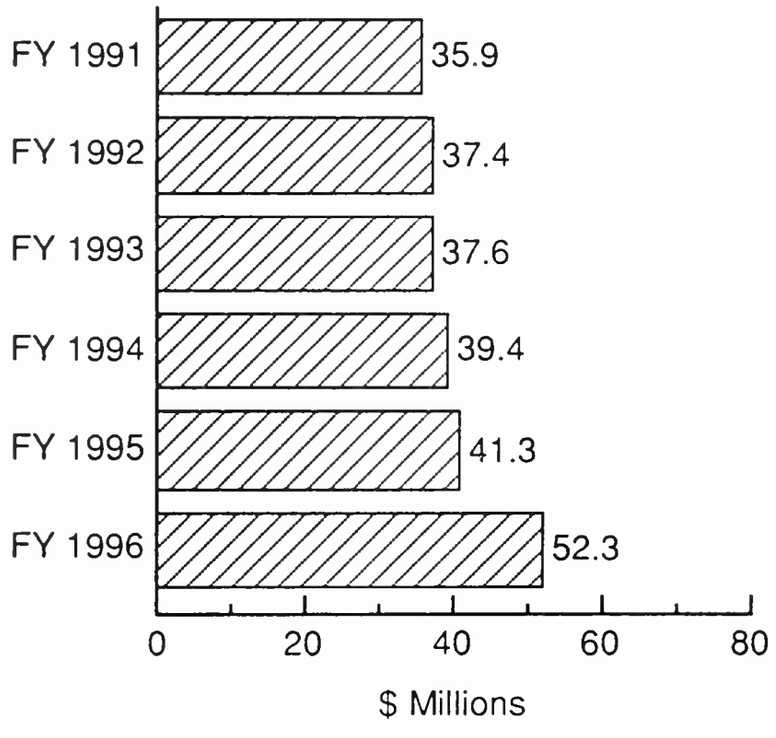
The Contracting Office indicated that the value of the first increment of TMIS was approximately $89.7 million, spread among various market segments. However, the contract will have a value of approximately $331 million over several years.

In 1989, Boeing awarded a contract to Intergraph for the TMIS Program. The contract was for the supply of workstations loaded with computer-aided engineering, design, and publishing software, as well as some advanced software for design analysis and animation.

Funding for the Space Station TMIS Program appears in Exhibit V-1. These figures were obtained from NASA's FY 1992 A-11 budget submissions to OMB. According to the A-11, funding is for Space Station TMIS ADP equipment purchases in support of multiple projects. Items to be purchased include software, data entry, and keypunch services, ADP operations services, maintenance, and analysis and programming.

EXHIBIT V-1

Space Station TMIS Funding—FY 1991-FY 1996



Source: NASA's FY 1992 A-11 submissions to OMB

2. Customer Data Operation System (CDOS)

NASA has established the Customer Data Operations System (CDOS) to adjust the NASA practice of supporting customers in launch activities, including communications with the Space Station and control centers. Although CDOS is not part of the Space Station proper, it is allied with the Space Station.

As such, CDOS has a schedule consistent with Space Station needs and its budget is currently linked to that of the Space Station. The CDOS Program Office is located at Goddard Space Flight Center.

Funding for this program provides for the definition, design, installation, and maintenance of the control center for the Space Station platforms (Polar and Co-Orbiting). The System provides general communications from the White Sands Missile Range to the entire Space Station communications network, plus some of the return communications.

The objective of the CDOS program is two-fold: first, to improve transmission of and accessibility to scientific data from experimental payloads; and second, to allow scientists to control a payload within certain limitations as if it were in the laboratory.

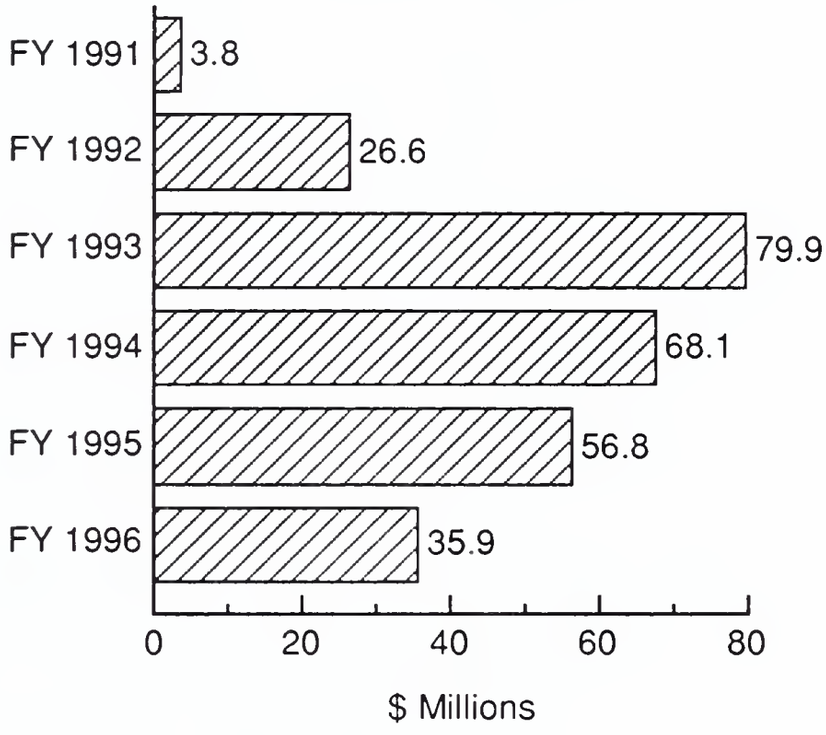
According to the CDOS Program Office, the preliminary design would be worth $2-4 million per contract, and the full implementation would be worth $200-400 million. Exhibit V-2 shows CDOS funding from NASA's FY 1992 A-11 budget submissions to OMB.

Phase B of CDOS was awarded to Martin Marietta and TRW in May 1989 for $2.5 million each. This phase was a study contract for the completion of the preliminary design of the system. The contractors performed parallel studies, but were not in competition with each other. Phase B resulted in government-owned reports, which will generate new procurements for Phase CD. A government team will use these reports to write original specifications and a set of requirements for Phase CD.

Phase CD will be an open and competitive procurement for the full implementation and acceptance testing of CDOS. The Phase CD contract will include hardware, software, and professional services.

According to the contracting officer, Phase CD is on hold. At this writing, a procurement schedule does not exist.

EXHIBIT V-2



Source: NASA's FY 1992 A-11 submissions to OMB

B

Earth Observation System

After the Space Station Program, NASA IRM executives cited the Earth Observation System (EOS) as the next most dominant NASA initiative for the 1990s. EOS is an integral part of Earth System Science, which is a joint effort among NASA, NOAA, and the National Science Foundation. The goal of the Earth System Science Program is to obtain a scientific understanding of the entire Earth system on a global scale. To accomplish this, the Earth System Science Committee intends to describe how the earth's component parts and their interactions have evolved on all timescales. Upon meeting this goal, the Committee hopes to have the capability to predict changes that will occur in the next decade to century, both naturally and in response to human aircraft.

In particular, EOS will be a global observing system using polar orbiting platforms in space, which will transfer research and operational data through an advanced information system on Earth. Instrumentation to be used includes the following:

- A group of instruments that images the earth's surface in the visible, infrared, and microwave region

- A complement of radar instruments that will gather information on the character and structure of the earth's surface

- A group of instruments designed to study the composition and dynamics of the atmosphere and to measure the earth's energy balance

Because of the size of this program, NASA broke EOS into three parts:

- Earth Observing System Data Information System (EOSDIS) Core System (ECS)

- Spacecraft and Platform

- Instrumentation

Goddard Space Flight Center will manage all three programs. The lifespan value of EOS is estimated at between $15 billion and $30 billion.

The EOS program requiring the most information technology is the EOSDIS. The initial ten-year contract for EOSDIS, known as ECS, is estimated to be worth $500 million. The entire EOSDIS is expected to reach $800 million. Funding for EOSDIS is shown in Exhibit V-3.

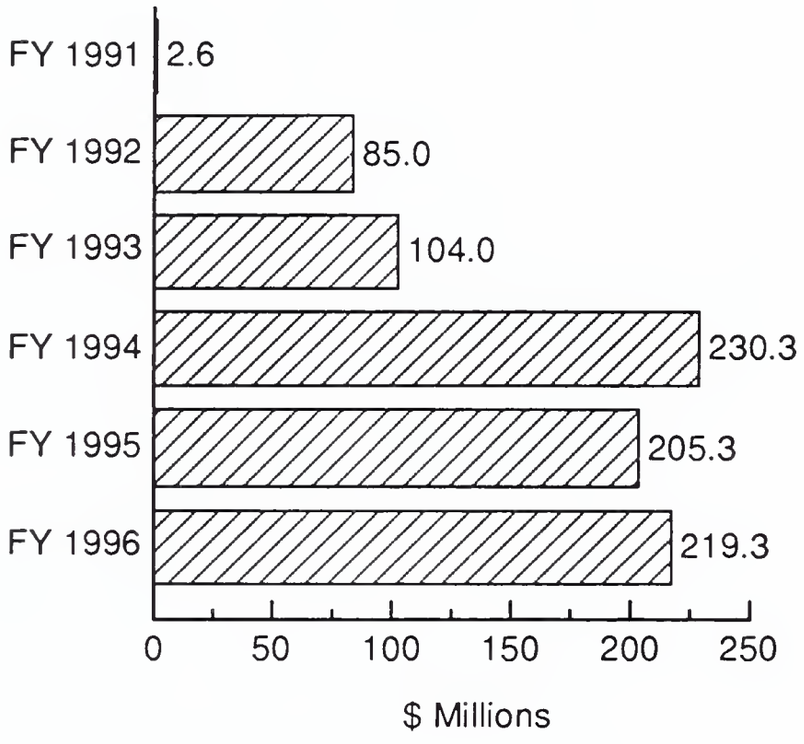
The ECS contract will involve design, development, implementation, testing, delivery, and initial maintenance of the ECS ground system. The ECS will be an evolutionary, geographically distributed system that will acquire, process, store, and distribute earth science data recorded by the Earth Observing Satellites.

The ECS procurement will be carried out in phases. TRW and Hughes completed Phase B in April 1990. Each company presented a model land workstation which receives information from the space platforms and preprocesses, distributes, and archives the data. These proposals were combined in the specifications for Phase CD of the ECS program. Phase CD will be an open and competitive procurement for design and development of the station.

The RFP for ECS Phase CD was released on July 1, 1991 and bids were submitted September 3, 1991. The three prime contractors pursuing ECS are TRW, Hughes Information Technology, and GE Aerospace. At this writing, proposals are under evaluation. An award is expected in the first quarter of FY 1993.

EXHIBIT V-3

EOSDIS Funding—FY 1991-FY 1996



Source: NASA's FY 1992 A-11 submissions to OMB

Currently, a White House panel is now starting to rethink the ECS program. Concern has grown that the ECS program may not be the most cost-efficient alternative because of its massive size. Some experts believe NASA might be better served by splitting the procurement up among several vendors. The panel is concerned that the program could lead to an unmanageable, expensive data system that would be unable to respond to budget fluctuations and user demands. The panel suggested that more time and effort be put into the evaluation of the data systems requirements before awarding the procurement to just one vendor.

Although the three possible primes have gotten most of the attention, a large part of the funding is expected to go to a wide variety of computer hardware and software suppliers that will provide the equipment needed to build the system. If NASA re-evaluates the program and changes ECS requirements, the door will be open for even more companies.

IT contracting opportunities may also be found in projects that will support EOSDIS, such as the ECS IV & V procurement. This procurement will provide an independent contractor to monitor the performance of the winning contractor of the ECS. Because of the tremendous size of the

ECS and NASA's lack of internal capability to monitor such a large program an independent source will be employed to track the progress of the ECS contractor. Industry officials estimate the ECS IV & V contract will be worth $68 million. A Request for Information (RFI) is expected to be released in the second quarter of FY 1992 by NASA.

C
Major Information Systems Initiatives

In addition to the initiatives already described, NASA has numerous other significant activities aimed at modernizing its information technology activities and better supporting its mission. NASA's most recent OMB A-11, 43B submission, published in March, 1991, contains more than a hundred distinct line items. Chapter VI contains more information on agency buying plans, and Chapter VIII contains specific marketing opportunities that INPUT has researched and identified.

1. Numerical Aerodynamic Simulation (NAS)

Ames Research Center is developing the NAS program to establish and maintain a leading-edge national computation capability. Through the NAS program, NASA intends to ensure leadership in computational fluid dynamics and related disciplines. Through continued state-of-the-art performance, researchers in computational fluid dynamics can address the next level of significant computational problems in the field of aerodynamics research.

Aerodynamics simulation represents one of the key emerging technologies that will strengthen aeronautics research. It will also develop technology promoting U.S. leadership in civil and military aviation. NASA is implementing the NAS program in stages. It will be implemented with a standard operating system, UNIX. NAS will include high-speed processors, an integrated support processing complex, graphic workstations, and communications networks. It will be completely interconnected and provide users with a standard operating environment through the NAS Processing System Network. NAS represents yet another example of NASA's move away from self-contained independent systems.

According to NASA's most recent 43B submission, the NAS system is funded as follows:

FY	1991	1992	1993	1994	1995	1996
$M	41.7	46.7	51.5	55.9	59.5	50.3

2. Scientific Computer Operations Programming and Analysis (SCOPAS)

Langley Research Center maintains a Central Scientific Computer Complex to support its research and development in the areas of aircraft technology, aerospace vehicle acoustics, space electronics, atmospheric sciences, and computer sciences.

Unisys presently manages the scientific computer operations at Langley. Unisys' responsibilities include the following:

- Operation of the computing, preparation, data recording, data transcription and plotting equipment
- Computer operating systems support
- Services to provide for analysis of the performance of hardware and software systems
- Research data reduction services
- Facility monitoring services

The Unisys contract expires in the fall of 1993. The recompetition process will begin in the fall of 1992. The current contract is valued at $16.7 million.

Funding for SCOPAS is included in NASA's 43B line item entitled "LARC Central Scientific Computer Complex." Funding is as follows:

FY	1991	1992	1993	1994	1995	1996
$M	11.9	11.6	11.2	10.6	10.7	11.3

3. Engineering Analysis and Data System (EADS)

Marshall Space Flight Center acquired the EADS to meets its scientific and engineering computational requirements. With its vector processor nucleus, EADS provides ultra-high-speed computing to meet these needs. Specifically, EADS supports the analysis of structural, thermal, control system, fluid dynamics, and optical characteristics of space vehicles and payload.

Currently, a Cray supercomputer system supports the EADS. At this writing, NASA is expanding and upgrading the system to support more complex and analytical studies. This replacement program for EADS is called EADS II.

The contractor for EADS II will furnish all hardware, software, hardware maintenance, software support, systems support, and management necessary to provide a complete, operational system. This procurement includes a supercomputer, networking, image processing, mass storage, minisupercomputers, high-performance graphic workstations, software and support.

The EADS II RFP was released in June 1991. At this writing, Marshall Space Flight Center is assessing the benchmark requirements of the EADS II solicitation, and the due date for proposals has been extended indefinitely.

EADS II received a $192 million DPA in April 1991. According to NASA's FY 1992 43B submissions, EADS funding is as follows:

FY	1991	1992	1993	1994	1995	1996
$M	17.5	18.9	18.5	18.6	18.7	18.8

4. Computational Mission Services

The Marshall Space Flight Center operates at the Army's Redstone Arsenal facility in Huntsville, AL. It manages, develops, and tests the space shuttle's main engines and associated fuel systems. It also manages the spacelab and space telescope programs. Marshall supports NASA programs in electronics, guidance, navigation and control.

Presently, the Computational Mission services are being performed by Boeing Computer Services. Boeing is responsible for systems engineering, operation and maintenance, and software development. Boeing was awarded this ten-year contract in 1987.

According to NASA's FY 1992 43B submissions, Computational Mission Services funding is as follows:

FY	1991	1992	1993	1994	1995	1996
$M	13.1	13.5	14.1	14.3	14.6	14.7

5. Applications and Analysis Support for the Mission Support Directorate

This program provides for resource and program support to the Mission Support Directorate at Johnson Space Center. This program includes program, technical, and business management; security technical support; program control; and applications analysis tasks. McDonnell Douglas holds the current contract, which expires in December 1992.

According to NASA's FY 1992 43B submissions, funding for this program is as follows:

FY	1991	1992	1993	1994	1995	1996
$M	6.2	6.5	6.9	7.2	7.6	8.0

6. White Sands Test Facility Support

This program provides for technical assistance, systems engineering, and other ADP support for the White Sands Test Facility, part of Johnson Space Center. This contract has been held by Lockheed Engineering and Sciences Company since 1989. Lockheed's contract expires in January 1994.

According to NASA's FY 1992 43B submissions, funding for this program is as follows:

FY	1991	1992	1993	1994	1995	1996
$M	2.5	3.3	3.2	2.9	3.3	3.5

D
NASA's Use of Technology

Given the highly technical nature of NASA's mission, one would expect a heavy commitment to advanced technology throughout NASA. This is largely the case. Along with Energy and Commerce, NASA is heavily committed to the use of supercomputers. As discussed earlier in this chapter, NASA is now taking steps to share supercomputer technology across centers.

Ames Research Center is scheduled to award several major supercomputer contracts in the next few years. One procurement is for supercomputers and associated professional services for the NASA Processing System Network (NPSN). This system will feature prototype high-speed processors as they become available, and a supporting system consisting of workstations, graphics stations, and mass data storage.

Another Ames procurement entitled "Testbed I Computer Systems" will provide an advanced parallel processor to the NASA facility. This facility is one of the premier supercomputer centers in the world and provides scientific computational services to a wide range of local and remote users representing NASA, other government agencies, academia, and industry.

NASA has long prided itself on buying the latest and fastest supercomputers. One goal of the previously mentioned NASA program is to keep in place the world's fastest supercomputers for computational science and modeling. NASA is also involved in the High-Performance Computer and Communications (HPCC) program, the primary mission of which is to develop a next-generation machine of tera-FLOPS power.

Although NASA is attempting to employ the latest technologies in its projects, its approach to new information system development is changing somewhat. In the past, NASA developed new systems from scratch in support of a specific project. New projects justified new information systems. This can be an expensive process. NASA is now learning to do more with less.

It is attempting to cut costs by rethinking the way it approaches information system design and use. It is beginning to develop systems to support multiple missions.

One example of NASA's efforts is the Space Flight Operations Center (SFOC) program at the Jet Propulsion Lab. SFOC is an information system program in which systems are being developed that can serve not only the Magellan space probe effort but also future missions. When SFOC becomes fully operational, it will be integrated with mission-specific ground systems to provide key data services to six spacecraft, including ongoing missions such as the Magellan Venus-mapper and upcoming visits to Mars and Saturn.

NASA IRM executives state that NASA aims to use and develop new technology within applicable programs. They stress that NASA uses technology where it is appropriate to achieve a program's mission. NASA does not develop technology just for the sake of technological advancement. Part of this stems from balancing the use of new technology with the risk to human life.

The following discussions cover other key technology areas at NASA.

1. Data Management and Storage

NASA's space missions generate a tremendous amount of data and thus pose severe data management concerns. The areas of processing, distribution, and archiving of space science data have caused NASA to allocate much of its computer resources to formulating an environment that supports the operations and research users of information systems.

Data management systems attempt to get the acquired data into accessible and archival mechanisms as quickly as possible. However, this task becomes more difficult as the volume of data generated increases. Future programs such as the space telescope and remote sensing programs for the mid-1990s are estimated to generate as much as a trillion bytes of data per day.

Another example of a future large scientific program that is expected to generate much data is the Earth Observation System (EOS). EOS will be a remote sensing program. In order to estimate the data management requirements for EOS, Goddard Space Flight Center plans to establish an EOS Data and Information Systems Design study by industry vendors and also to complete in-house studies.

INPUT's survey of NASA respondents revealed a growing concern regarding data management and storage technologies. Many offices are investigating improvements in end-user tools, more developed graphics, and security requirements for data bases. Optical disk storage is being explored, since much of NASA's data must be stored on-line.

Because of the high volume of scientific data at NASA, the National Academy of Sciences Space Science Board established the Committee on Data Management and Computation (CODMAC). In the 1982 report, CODMAC concluded that:

- There was insufficient involvement of scientists in the data management process.
- Data analysis funds were inadequate and often were reprogrammed due to hardware overruns.
- NASA had not exploited or implemented current data system technologies.
- A responsible scientific group for data management during and/or after missions was not clearly identified.
- The method NASA generally used to distribute, store, and communicate data limited the efficient extraction of scientific results from space missions.

To improve data access and quality, the report recommended the following steps:

- Greater development and use of software standards
- More emphasis on data documentation

- Use of more modern technology
- More frequent updating of computing facilities
- Active involvement of scientists in the planning, acquisition, processing, and archiving of data in order to maximize the science return

In the intervening years, NASA has taken numerous steps to implement this recommendation.

2. Telecommunications

NASA's major telecommunications systems serve to acquire, transmit, and distribute space science data obtained from the agency's satellites, scientific probes, and spacecraft in low Earth orbits. At present, NASA has two telecommunication systems, the spaceflight tracking and data network, and the space network. NASA's data processing and analysis requirements will grow tremendously when such future operations as the Space Station, the shuttle, and the Hubble Space Telescope contribute to the data traffic. Therefore the agency is formulating its plans to handle the data demands with more advanced telecommunication systems.

The space network serves to replace the older, ground-based spaceflight tracking and data network. It is a space-based system that uses high orbiting satellites, called tracking and data relay satellites, to relay communications between ground stations at White Sands, New Mexico, and low Earth-orbiting spacecraft. NASA plans to rely on the space network to relay data, commands, and telemetry between low Earth-orbiting spacecraft and the ground.

NASA uses two different systems for transmitting data among different NASA agency locations. The first, NASCOM, transmits science and telemetry data. The other, called the Program Support Communications Network (PSCN), carries program-level information. NASA is one of the agencies most active in the use of local-area networks (LANs). LAN use has increased because LANs are highly effective and cost efficient compared to wide-area networks. At present, general data and administrative applications are heavily supported by LAN services, while the technical and scientific application will be further developed.

In another example of NASA's effort to connect its systems, the Johnson Space Center continues to promote connectivity through its Center Information Network (CIN). CIN achieves compatible communications among all major networks at JSC. It also supports user-to-applications connectivity to all IBM-hosted centers and NASA uniform systems and programs. The CIN is based on IBM's System Network Architecture (SNA) and

provides gateways to the Digital Equipment Corporation Network (DECNET) and other local-area networks. Within JSC, the CIN interfaces to the Program Support Communications Network (PSCN) and the Center Telecommunications System (CTS).

Langley Research Center has established its own LAN, known as Larcnet. It consists of more than 26 Ethernet LANs, linked into a centerwide LAN and a Pronet-10 token-ring backbone network provided by Proteon, Inc. of Westborough, Massachusetts. Larcnet supports multiple data communications protocols simultaneously. It aims to standardize on DoD's TCP/IP family of protocols. The Langley Research Center shares its site with Langley Air Force Base. Although Larcnet currently accommodates Xerox Network Systems (XNS) protocols in addition to TCP/IP, the XNS protocols are being phased out.

Currently, more than 400 computers are connected to Larcnet, including:

- Control Data Cyber supercomputers
- IBM mainframes
- Prime Computer minicomputers
- Digital PDP-11, VAX, and Micro VAX systems
- Sun Microsystems workstations
- Iris Graphics scientific workstations
- Various IBM and compatible personal computers

Larcnet supports a variety of transmission media, including high-bandwidth fiber optic cable. This medium resists electrical interference that can cause data transmission errors. It also provides security from electronic eavesdropping and can provide fault-tolerant operation over large geographic distances.

At Ames, a LAN is supporting image storage design initiatives. Avtex Research Corporation of San Jose, California, installed an optical storage system to interface through the LAN. An Ames worker at a properly equipped personal computer anywhere on the network will be able to search and display digitized images from a data base that will eventually grow to 35,000 items. The image data base resides on two write-once/read-many (WORM) laser drives, provided by Micro Design International of Winter Park, Florida.

In 1976, Kennedy installed fiber optic cable throughout a series of underground ducts. For the past 15 years, it has proven to be an extremely reliable transmission medium. Kennedy uses the cable to support its electro-optics laboratory, where it serves as a reference for systems development and evaluation of new equipment. Kennedy's previous copper-wire communications cable was being eaten away by corrosion and brackish water. However, the current cable has withstood the Florida elements, with little apparent attenuation in signal. Today, NASA uses fiber optics for all space center wide-band communications.

3. Software

NASA uses a variety of software languages, standards, DBMSs, and utilities to meet its mission requirements. The software issues associated with data management have already been discussed. Several oversight bodies have expressed concern over the interface challenges associated with multiple languages.

In response to this need, NASA has established its own standardized approach to life cycle management of software and information systems. The agency has established the Software Management Assurance Program (SMAP) in order to acquire quality software and minimize software acquisition costs. A large package of software management aids including policy, guidelines, standards, and training has been prepared under the guidance of the SMAP office. The Space Station program will utilize the SMAP standards, which are derived from mil-std 2167, already a widely used military standard for software documentation and life cycle management. Other federal agencies, such as the Coast Guard and the FAA, have expressed an interest in adopting the standards established by SMAP.

NASA has also begun to make more use of artificial intelligence (AI) in scientific and decision support systems. Goddard recently held a conference in the space applications of AI. NASA's Mission Operations and Data Systems Directorate sponsored the program, which included discussions on machine vision, intelligent user interfaces, fault isolation, and other knowledge-based systems.

In interviews with INPUT, agency executives expressed high hopes for the future of AI at NASA. For example, in the area of decision support systems, AI can support analysis of photographic data coming back from space. This will reduce the people-intensive aspects of this area.

NASA is making growing use of graphics technology in supporting its mission. The Office of Aeronautics and Space Technology (OAST) at NASA headquarters uses Apple Macintosh systems for a variety of applications. OAST is NASA's primary research and development division. It supervises NASA research facilities at Lewis, Ames, and the Dryden Flight Research Facility at Edwards Air Force Base in California. OAST awarded a $2.5 million contract to Falcon Microsystems for 168 Macintosh IIs for its own use. The Macs will interface to various installed VAX systems at NASA. In some cases, the Macs will replace old Digital equipment.

E
Budget Trends

Exhibit V-4 summarizes recent NASA total funding information (not just IRM funding). NASA funding appears to be steadily increasing.

EXHIBIT V-4

NASA Funding Summary
($ Millions)

	Budget Authority	Outlays
1989 Actual	10,969	11,036
1990 Estimate	12,324	12,026
1990 Actual	12,324	12,429
1991 Estimate	13,977	13,499
1992 Estimate	15,723	14,721
1993 Estimate	17,176	15,813

Source: President's Budgets for FY 1991 and FY 1992

Within the proposed FY 1992 budget, the research and development category shows the greatest increase. The proposed increase from FY 1991 to FY 1992 is 20%, bringing the estimated total research and development funding for FY 1992 to $7.2 billion. This increase includes programs such as the space station, and also includes some additional funding for unmanned scientific applications.

The FY 1992 budget proposes a total of $15.7 billion in new budget authority, including the following:

- Space Flight, Control, and Data Communications—$5.6 billion
- Construction of Facilities—$480 million
- Research and Program Management—$2.5 billion

Most of the budget increase is required to carry forward the ongoing programs approved by Congress for FY 1992. It is also noted that the FY 1992 budget will support expansion of the private sector's role in space.

Exhibit V-5 summarizes IRM funding for some of NASA's major programs.

In performing its mission, NASA relies heavily on information technology and spends about 10% of its annual budget on this technology. According to the Office of Management and Budget, NASA is planning to acquire more information technology over the next five years than almost every other federal civilian agency. The agency's long-range plan for fiscal years 1991 through 1996 lists over 100 projects costing $1 million or more over this five-year period. NASA's FY 1992 IRM budget is $1.7 billion.

EXHIBIT V-5

Major NASA Program Funding
($ Millions)

	FY 1991	FY 1992	FY 1993
Space Station TMIS	35.9	37.4	37.6
Ames Computer Systems and Research Division	17.7	18.5	19.2
Ames Numerical Aerodynamic Simulation Systems	41.7	46.7	51.5
Goddard Customer Data Operations System	3.8	26.6	79.9
Goddard Multi-Satellites Operations Control Center	15.3	22.7	24.0
Goddard Command Management System	16.3	23.2	25.9
Goddard Operations Support Computing Facility	34.0	45.5	46.3
Marshall SDI Computational Mission Services Contract	45.3	51.8	60.4
Marshall Engineering Analysis and Data System (EADS)	17.5	18.9	18.5
Marshall Computational Mission Services Contract	13.1	13.5	14.1
Johnson Mission Operations Directorate	158.5	160.3	170.6
Johnson Information Systems Directorate	59.7	68.7	73.5
Johnson Space Station Training Facility	22.5	28.0	28.8
Johnson Space Station Control Center	31.8	50.4	55.6
Kennedy Space Station Test, Control and Monitoring System	25.3	30.9	34.7
Kennedy Checkout, Control and Monitor System II	17.3	32.8	48.5

Source: NASA's FY 1992 A-11 submissions to OMB.

VI

Acquisition Plans and Procedures

A

Use of Information Services Vendors

NASA uses information services vendors when there are in-house staffing limitations, budget constraints, and when the contractors can provide experience and expertise that is not available extensively within the agency. Exhibit VI-1 depicts the percent of surveyed agency respondents that use each service category and each category's average share of the respondents' information technology budgets.

EXHIBIT VI-1

Types of Information Services Contracted For By NASA Respondents

Service Category	Percent of Respondents Currently Contracting for Service	Average Percentage Share of Respondents' IT Budgets
Professional Services	100	15
Hardware	100	23
Software	92	24
Telecommunications	92	8
Systems Integration	85	9
Facilities Management	62	13
Processing Services	38	8

The NASA agency respondents represent a wide distribution of headquarters offices and NASA research and space centers. Therefore, their specific information service requirements and IT budgets are diverse. With the exception of processing services, the majority of surveyed organizations contract for all categories of information services.

B

Changes in Contracted Services

Exhibit VI-2 reflects NASA agency respondents' projected changes for contracted services over the next five years. The largest percentage of respondents anticipated increases in telecommunications, software, and hardware services. This is in sharp contrast to the vendor respondents that expected the largest increases to occur in the acquisition of professional services and systems integration contracts. The differences in the agency and vendor perceptions of future increases in services may stem from their varied classification of services and different orientations to the time frames for design and implementation of NASA's major programs. This result is to be expected in the decentralized environment in which NASA operates.

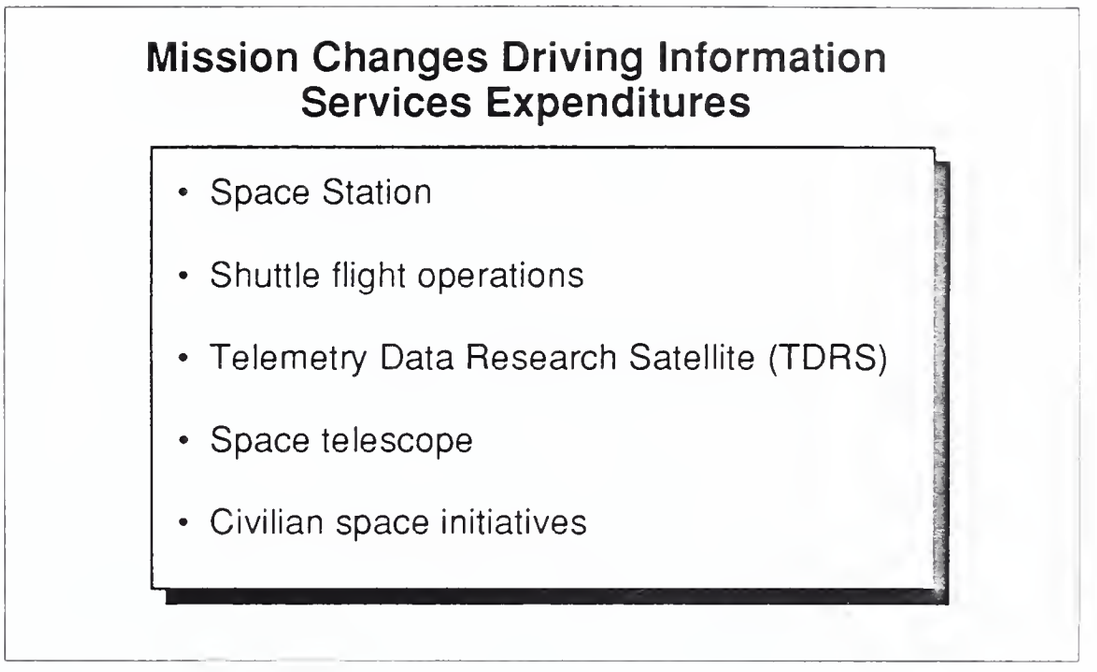
EXHIBIT VI-2

NASA Agency-Projected Changes for Information Services Contracting Over the Next Five Years

Service Category	Average Percent of Respondents			
	Expected Increase	Expected Decrease	No Change	Average Change (Percent Increase)
Telecommunications	46	–	54	28
Software	46	–	54	25
Hardware	46	–	54	20
Professional Services	38	–	62	13
Systems Integration	31	–	69	10
Facilities Management	23	–	77	30
Processing Services	23	–	77	17

NASA respondents were queried as to what mission changes, if any, were driving changes in information services. Sixty-five percent of those interviewed stated that adjustments to the agency's mission were a factor contributing to changes in spending for contractor services. Exhibit VI-3 lists the most frequently cited programs and operations for which mission changes will impact expenditures.

EXHIBIT VI-3



C

Application Areas

The various NASA research and space centers, as well as the headquarters sites surveyed, utilize information services contracts for many different applications. INPUT lists the general function and applications categories for the contracted services in Exhibit VI-4.

The predominant applications for which services are contracted are those associated with general data processing in support of the agency's mission and computer systems requirements. Besides technical or scientific applications, the agency also has many specific "mission-oriented" applications that require custom software development and engineering services that are contracted to vendors. Other applications cover a range of information systems and appear unique to the individual needs of each segment of the agency.

EXHIBIT VI-4

NASA Functions and Applications Being Contracted

- Systems operations
- Space Station Program
- Research and technical operations
- ADP support services
- Software development
- System engineering and analysis support
- Tracking operations
- Maintenance
- Administrative applications
- Telecommunications

NASA respondents were also asked whether the agency usually transfers continued support in-house or leaves support with the contractors when a commercial services contract is completed. The majority (71%) of the NASA agency respondents stated a preference for continuing the support services through a contractor. When the agency respondents were queried about whether there were any additional ADP support applications that would be converted from in-house to contractor, only 13% of the respondents replied that there were any services not already being contracted that would be converted. The additional applications cited include programming, operations and maintenance, and facilities management.

D
Vendor Types

Respondents were asked which type of vendor appears more desirable for performing required information services (see Exhibit VI-5). Based on frequency of mention, professional services vendors were preferred, while a large share of the agency respondents also used "all types of organizations."

EXHIBIT VI-5

NASA Agency Vendor Type Preference for Information Services

Vendor/Organization Type	Agency Respondent Ranking*
Professional Services Firms	1
"All" Types	2
Communications Firms	3
Aerospace Companies	4
Hardware Manufacturers	5

* Based on frequency of mention by respondents

The respondents based their selection of a type of organization on whether the chosen firm met a variety of needs and was knowledgeable in specialized applications. NASA has some unique experience requirements of vendors in order for them to be suitable to participate in certain types of technical projects. Presumably, the agency does not believe that all vendors are capable in all areas; rather, it views vendors according to the vendor's own skill focus and prefers to match that focus to the requirements of the project. Therefore, communications firms, aerospace companies, and hardware manufacturers come into the program when their particular skills and products are closely tied to the requirements of the system or project.

E
Selection Criteria

The ranking by NASA representatives as to which criteria are most important in the selection of an information services vendor is shown in Exhibit VI-6. The criterion viewed as most important by both the agency and vendors is the proposed technical solution. Life cycle cost was the second most important criterion according to the agency ranking, whereas vendors placed initial cost second. The agency respondents ranked initial cost least important.

EXHIBIT VI-6

Relative Ranking of Criteria Used in Selecting an Information Services Vendor

Selection Criteria	Agency Ranking*	Vendor Ranking*
Proposed Technical Solution	1	1
Life Cycle Cost	2	3
Contract Type	3	5
Risk Containment Procedures	4	4
Initial Cost	5	2

* Ranking based on an average of the level of respondents' ratings.

F

Contract Types

The NASA respondents surveyed indicated a clear preference for using cost-plus types of contracts for most information services, as shown in Exhibit VI-7. Cost-plus-award-fee contracts were most common. In the procurement of telecommunication services and hardware, the agency preferred fixed-price contracts. The vendor community was evenly split in its opinions of whether cost-plus, fixed-price, or a "mix" of contract types would dominate over the next five years as the most preferred contract vehicle.

NASA plans to meet its future information services and system requirements using a variety of methods, as shown in Exhibit VI-8. According to those surveyed, 30% anticipated that they would buy hardware components separately and integrate in-house. Twenty-five percent (each) planned to either purchase system components and use an integration contractor or buy a complete integrated system. Like the Department of Energy and some Commerce agencies, but unlike most other agencies, NASA acquires components separately in a majority of cases.

EXHIBIT VI-7

NASA Agency Contract Type Preference for Information Services

Services Category	Respondents Contract Type Preference		
	Cost-Plus (Percent)	Fixed-Price (Percent)	Mixed (Percent)
Professional Services	67	3	—
Facilities Management	47	40	13
Software	40	40	20
Processing Services	54	46	—
Systems Integration	61	31	8
Telecommunications	27	53	20
Hardware	6	94	—

NASA is increasing its reliance on systems integrators to develop, upgrade, or replace automatic data processing systems. Also, demands from all parts of the agency for additional MIS support are mounting. Furthermore, systems integration is being used to assist the agency in the automation of information systems that support mission activities that now require better solutions to handle diverse applications.

EXHIBIT VI-8

Agency Methods for Acquiring New or Enhanced Services and Systems

Method	Percent of Respondents
Buy components and integrate in-house	30
Buy components and use a integration contractor	25
Buy integrated systems	25
Combination of methods	20

Systems that exist to handle data from the various research and space centers, as well as within headquarters, need to be integrated to facilitate document exchange capabilities. Concerns with transmission speeds and storage size requirements will remain key concerns to NASA in its design and development of integrated systems. NASA has recognized the need to incorporate technological advances and add new capabilities.

G

Budget Constraints

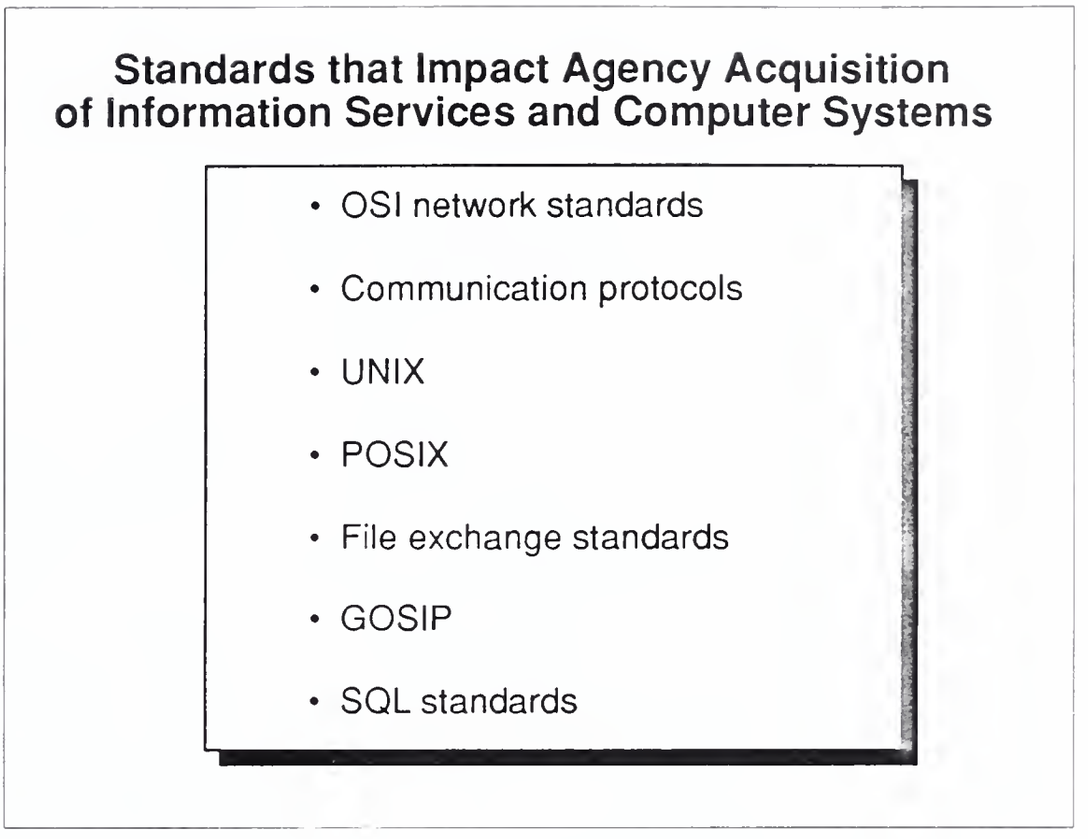
The Gramm-Rudman-Hollings Act imposed cuts in federal agency expenditures in 1986 and 1987 that resulted in limitations in growth of some areas of the information services market. NASA respondents were asked about the impact, if any, that Gramm-Rudman-Hollings and other budgetary constraints had on their acquisition of services. The Act had limited direct influence on most agency respondents; however, it did cause some delays or postponement of services. The areas reported to be the most affected are the scientific programs.

H

Standards

Agency respondents were asked what standards they perceived as having an impact on their agency's acquisition of information services and computer systems. As shown in Exhibit VI-9, agency policy makers and planners face increasingly complex choices regarding the selection and enforcement of telecommunications standards. Such standards, however, are a key element of agency strategies to achieve interconnection and interoperability for existing and planned systems at NASA. In terms of ranking, respondents did not stress any particular standards over others.

EXHIBIT VI-9



I

Agency Perspectives—Industry Trends and Technology

INPUT asked agency officials their views on industry trends and major technological developments in the areas of telecommunications, end-user computing, and information management—areas that will impact future NASA spending on information services. (See Exhibit VI-10.) NASA has technically oriented concerns regarding developments in telecommunications that, when resolved, will serve to extend both the headquarters' and space centers' communication capabilities.

NASA's end-user computing is critical to its space operations. The advancements outlined in Exhibit VI-10 point out the agency's reliance on powerful computers and graphics capabilities, which are perceived as undergoing improvements.

EXHIBIT VI-10

Industry Trends and Technological Factors Affecting Future NASA Spending for Information Services

Telecommunications

- Standards development and interconnectivity
- Greater use of distributed networks and improvement to LANs
- Improved speed of data transmission
- Developments in fiber optics
- Extensive interagency networks
- Developments in artificial intelligence

End-User Computing

- Improved capabilities of workstations
- More-powerful computers at lower cost
- Software productivity improvements
- Increased use of distributed computing
- Supercomputers accessible at workstations
- Advancements in graphics capabilities

Information Management

- Need to incorporate graphics into data base management
- Develop common user interfaces with UNIX
- Improvements in optical disk storage
- On-line storage for massive amounts of data
- Use of smart-card technology for exchange of data
- Greater software portability

Data storage and software developments were the major concerns of the NASA respondents as they look to the future of information management at NASA. NASA's continued push for state-of-the-art technology will make the vendor community strive to deliver storage devices suitable to NASA's unique requirements.

VII

Vendor Views

A
Products and Services

The vendors surveyed provided to NASA each of the categories of information services as shown in Exhibit VII-1. The largest share of vendors provided professional services and software services and products under their current contracts. Additional related services offered by the vendors included technical and scientific support services.

EXHIBIT VII-1

Type of Information Services Provided to NASA by Respondents

Service Category	Percent of Respondents Currently Providing Service
Professional Services	100
Software and Related Services	90
Systems Integration	80
Facilities Management	70
Hardware	60
Processing Services	60
Telecommunications	50

Vendors plan to continue to provide a wide range of information services in the future in response to the demands of NASA's space mission and information technology needs. Exhibit VII-2 profiles the vendors' ranking of the services they perceive as presenting the most opportunity for contracts at NASA in the future. Professional services heads the list, followed by systems integration. The vendors also view NASA as still relying on the purchase of additional hardware and software to support its operations.

EXHIBIT VII-2

Vendor Ranking of Most Attractive Opportunities for Products and Services at NASA

Product/Services	Rank
Professional Services	1
Systems Integration	2
Hardware	3
Software	4
Telecommunications	5

The reasoning behind the vendors' ranking of future opportunities for contracted information services is NASA's adherence to the OMB A-76 policy for contracting professional services, as well as the agency's utilization of a single contractor to be responsible for all aspects of integrating a system. These same factors also hold true for Exhibit VII-3, which identifies the expected percent changes in each service category over the next few years.

B

Changes in Contracted Services

Eighty percent of the industry respondents expected large increases in NASA's procurements for systems integration services (50% increase) and professional services (38% increase). The percent of expected increase for each service is an industry average derived from the respondents' views of the future growth in the NASA agency marketplace for these services, based on their own current contracting experiences. No vendors foresaw any decreases in contracting services.

EXHIBIT VII-3

Vendor-Expected Change in Contracting for Information Services at NASA

Service Category	Percent of Respondents			Average Change (Percent of Increase)
	Expected Increase	Expected Decrease	Expect No Change	
Systems Integration	80	–	20	50
Professional Services	80	–	20	38
Software and Related Services	60	–	40	25
Telecommunications	30	–	70	11
Facilities Management	30	–	70	10
Processing Services	30	–	70	7
Hardware	20	–	80	32

These vendor projections of changes in contracting for information services differ in all but one service category from the changes expected by NASA agency respondents. The single area of agreement on potential rate of growth is software, with an anticipated rate of 25%. In the agency survey results (See Exhibit VI-2), the NASA respondents estimated that contracting for systems integration services would increase by only 10% (versus vendor expectations of 50%), and that professional services would increase by 13% (as compared to 38% in vendor estimates). These smaller growth figures may have been derived from the agency respondent perceptions that these services are fully contracted already. The next category (in terms of agreement) is hardware, with vendors expecting 32% and agency personnel estimating 20%.

C

Application Areas

The vendors were queried as to which NASA application areas were supported by contractors. The listing in Exhibit VII-4 includes the general areas that industry respondents were supporting at the time of the survey.

EXHIBIT VII-4

Application Areas for Contracted Information Services at NASA

- Scientific data applications
- Facilities management
- Engineering
- Business systems
- Program support systems
- Document transfer system
- Data base management
- Document image processing
- Office automation
- Administration
- Mission operations support
- Command and control
- Training
- Networks

D
Mission-Oriented Contracts and Applications

Historically, mission-oriented contracting was to be a joint venture between NASA, the business community, and the academic community. Universities were to receive a large share of the R&D money. Presently, most of the R&D functions are contracted to a variety of vendors, as well as to universities and not-for-profit organizations.

The majority (70%) of the vendors surveyed have been awarded "mission-oriented" contracts from NASA. The applications included data analysis, operations support, engineering support, applications software, and portions of both the Space Shuttle and Space Station programs.

E
Selection Criteria

Vendors and NASA agency respondents considered the proposed technical solution the number-one selection criterion for a contract award, as shown in Exhibit VII-5. The vendors rated initial cost the second most important factor, whereas agency respondents concluded it was of least importance. Vendors commented that from their own viewpoint, NASA has become more attuned to cost and risk in its consideration of contracts.

EXHIBIT VII-5

Comparative Ranking of Selection Criteria for Contract Award at NASA

Vendor Rank*	Criterion	Agency Rank*
1	Technical solution	1
2	Initial cost	5
3	Life cycle cost	2
4	Risk containment procedures	4
5	Contract type	3

* Note: Ranking based on average of the level of respondents' ratings.

F
Preferred Contract Types

Vendors provide information services to NASA under a variety of contract types.

- Cost-plus contracts provide for vendor costs to be paid and a fee added that is either negotiated (cost-plus-fixed-fee) or based upon the performance of the contractor in satisfying the contract requirements (cost-plus-award-fee). Cost-plus contracts regulate the margin of profit allowed, but clearly place the risk with the government.

- Fixed-price contracts commit vendors to perform and complete a contract at a predetermined price ceiling. To a significant extent, the profitability associated with a fixed-price contract is dependent upon the vendor's ability to accurately appraise, in advance, the cost of providing services. Successfully managing fixed-price contracts requires an extremely well written and detailed statement of work and project scope. The risk of completion is placed on the vendor.

As shown in Exhibit VII-6, the vendors were also evenly split in their views of which contract type will dominate at NASA in the future. Vendors will continue to prefer a mixture of types of contracts in order to minimize their financial risks. This particularly applies to programming and analysis contracts, where the financial risks are substantial.

EXHIBIT VII-6

Vendor Preference for Contract Type with NASA

Preferred Contract Type	Vendors (Percent)
Cost-Plus	35
Fixed-Price	35
Mix	30

Vendors based their contract preferences on their own experience as incumbents for NASA contracts as well as on the nature of their products. They did not see any effect on the industry from the type of contract vehicle utilized. However, they did comment that to a greater extent contract selection by the agency should take into consideration how well defined the requirements are for the system. Lastly, vendors were concerned that with greater use of fixed-price contracts, contract management becomes more critical.

G

Industry Factors Affecting NASA Spending

Vendors surveyed by INPUT suggested numerous industry factors that could increase or decrease NASA's spending on information services in the next two to five years. INPUT grouped these factors into the five categories presented in Exhibit VII-7.

NASA contractors are very aware of the impact of the standards being established through a consensus of federal regulatory and standards organizations, industry organizations such as ANSI and IEEE, and the vendor community. NASA itself has several programs that coordinate standardization efforts for the agency. Most notable is the Software Management Assurance Program (SMAP), which functions to provide a standardized approach to life cycle management of software and information systems, and is being used for the Space Station Program.

The new federal GOSIP requirement mandating the use of OSI-compatible systems throughout the government will bring NASA closer to realizing its standardization needs. The policy for GOSIP will help establish consistency with commercial products development throughout NASA.

EXHIBIT VII-7

Ranking of Industry Factors Affecting Future Spending for Information Services

Factor	Rank*
Developments in OSI model and standards	1
Expanded applications for artificial intelligence	2
Establishment of Ada requirements	3
Increased applications for supercomputers	4
Changes in methods of distributed processing	5

* Rank based on frequency of mention by respondents.

Vendors also anticipate that NASA will be implementing artificial intelligence capabilities to support data processing control and handling functions, and safety applications for systems. NASA's Goddard Space Flight Center held a conference that included presentations on machine vision, intelligent user interfaces, fault isolation, knowledge-based systems and other AI topics, sponsored by NASA's Mission Operations and Data Systems Directorate.

NASA is one of the key civilian agencies that supports and promotes Ada. Vendors' comments indicated that they foresee the agency putting more effort into establishing Ada requirements for space programs in the future. Most of the vendors that support NASA have been migrating to the use of Ada to keep pace with future requirements.

The agency makes extensive use of supercomputers and is placing them throughout various locations for greater accessibility. NASA's use of supercomputers will be extended to applications that focus on each of its field installations' main functions and mission support activities. Furthermore, respondents noted that NASA is promoting UNIX and Ada requirements for supercomputer applications.

H

Technological Trends

The vendors interviewed for this report were asked to identify technological trends that might specifically influence NASA's procurements for information services. As should be expected, the perspectives varied with the primary level of business and the degree of involvement at NASA.

The technical trends identified varied widely. In descending order of frequency of mention, there were several principal trends, as identified in Exhibit VII-8. Increased data storage capabilities was cited the most often. Vendors said that the increase in storage requirements for large quantities of data will become even more severe with implementation of the Space Station programs and the increase of Shuttle operations.

EXHIBIT VII-8

Technological Trends that Impact Future Information Services Acquisitions

Factor	Rank*
Increased storage capabilities	1
State-of-the-art technology for graphics	2
Compatibility of architectures	3
Improved telecommunications capabilities	4
Advancements in networking standards	5

* Rank based on frequency of mention by respondents.

NASA is viewed by some respondents as being one of the key federal agencies pushing for state-of-the-art graphics and networking capabilities. Future graphics techniques, especially those that can be handled at the end user's workstation, will greatly enhance NASA's ability to handle and manipulate scientific data. Also in the future, resolving the interconnecting problems of the present system architectures and improving telecommunications capabilities will extend many of NASA's networks and data systems to a wider audience of potential users and unite their various sites. NASA is also viewed as migrating toward the networking of its supercomputers, moving it to the leading edge of supercomputer technology.

I Marketing Differences

Industry respondents were asked to comment on what they perceive as marketing differences between NASA and other government agencies. Their responses are exhibited in Exhibit VII-9. As might be expected, NASA shows a greater technological orientation. Through the relative autonomy of the centers, NASA usually contracts in a highly decentralized fashion.

EXHIBIT VII-9

NASA Agency Marketing Differences from Other Government Agencies

NASA Marketing Differences	Rank*
Greater technological orientation	1
Decentralized contracting	2
Increased client longevity	3
Limited classified data areas	4
Higher degree of professionalism	5

* Rank based on frequency of mention by respondents.

In addition, respondents stated that there appears to be greater client longevity at NASA, meaning that it was common to maintain the same vendor on a particular project for a lengthy time. For marketing purposes, NASA was favorably considered to have a limited classified data area, as compared to some of the DoD agencies. Also viewed as a benefit to vendors in their marketing to NASA was the fact that NASA's personnel display a higher degree of professionalism than those at most federal agencies.

J

Suggested Improvements to Products and Services

The industry respondents were asked what they believe vendors need to do over the next five years to make their products and services more valuable to the federal government. The replies varied due to the different types and levels of experience the vendors have encountered with NASA. In descending order of frequency of mention, Exhibit VII-10 lists the principal suggestions made by the respondents.

EXHIBIT VII-10

Suggested Improvements to Products and Services

Suggestion	Rank*
Become more solution oriented	1
Improve product compatibility	2
Increase flexibility to respond to changing requirements	3
Acquire personnel with proper background and skills	4
Reduce and control costs	5
Improve software engineering tools	6

* Rank based on frequency of mention by respondents.

The suggestion to become more solution oriented was cited most frequently as a means of making vendor services more valuable to NASA. To the extent that providing solutions will aid vendors' ability to be more responsive to the agency's needs, vendors should adopt this orientation. However, this finding is somewhat at odds with the agency survey, which still showed a preference for buying components separately. However, the need for improved product compatibility was right on the money. The increased sharing of NASA data, both within and between centers, will drive the compatibility need.

The hiring and training of the proper personnel to work on a government-awarded contract is an area of growing concern throughout the information services industry. Employing staff with the proper background to match NASA's specialized scientific and engineering task requirements was viewed by the vendors as an area that must be improved in the future. Vendors also found that developing methods to reduce and control costs and to improve software engineering tools would benefit both NASA and the vendors in the long run.

Key Opportunities

This section describes specific opportunities in the NASA information technology market. The opportunities list consists of major programs that are typical of the NASA market and serves as a representative sample.

A
Present and Future Programs

Funding for NASA is provided in several federal budget categories.

New NASA opportunities larger than $1-2 million are listed in at least one of the following federal government documents:

- OMB/GSA Five-Year Plan, which is developed from agency budget requests submitted in compliance with OMB Circular A-11.
- Agency annual operating budget requests submitted to both congressional oversight and appropriations committees based on the OMB A-11 information.
- *Commerce Business Daily* notice of specific opportunities, for qualifications as a bidder, and to obtain a copy of the RFP or RFI.

NASA opportunities are also identified in internal documents, such as the Information Technology System Plan (ITSP). Each NASA site submits this internal planning document for each fiscal year. These internal planning documents are not available to the public. NASA is preparing a consolidated five-year IRM plan for release in FY 1992. At this writing, the draft IRM plan is undergoing management review. NASA expects to release the plan in May 1992.

NASA tends to use integration contracts for larger, more complex systems. NASA programs may be included in these contracts, rather than being met through separate acquisitions.

The list of opportunities becomes smaller after FY 1992 because new programs have not yet been identified or initially approved by NASA. The INPUT Procurement Analysis Reports will include additional programs and detailed program information for FY 1991 to FY 1996.

All funding proposals are based on cost data of the year submitted, with inflation factors dictated by the Administration as part of its policy, and subject to revision, reduction, or spread to future years in response to Congressional direction.

B

NASA Opportunities

Site	Program	PAR Reference	RFP Schedule	FY91-96 Funding ($000)
ARC	Testbed I Computer System	VIII-15-098	4/1/92	20,000
ARC	Pioneer Data Processing	VIII-15-092	4/1/92	8,000
ARC	Data Communications Support	VIII-15-094	10/1/92	45,000
GSFC	NASA Communications Network	VIII-15-089	Unknown	*
GSFC	Customer Data and Operations Support	VIII-15-062	On Hold	200,000
GSFC	Advanced Tracking and Data Relay Satellite System	VIII-15-087	Unknown	3,000,000
GSFC	Mass Buy for Workstations	VIII-15-097	1/1/92	100,000
GSFC	IV&V Support Services	VIII-15-105	2/1/92	68,000
GSFC	Space Network Control Survey	VIII-15-096	2/18/92	*
GSFC	Engineering and Technical Services	VIII-15-103	1/1/94	*
HQ	NASA Occupational Health	VIII-15-070	On Hold	*
HQ	NASA Headquarters Facilities Management	VIII-15-104	4/1/92	60,000
JSC	Information Systems Contract	VIII-15-099	3/1/92	180,000
JSC	White Sands Test Facility	VIII-15-095	10/1/92	170,000

Site	Program	PAR Reference	RFP Schedule	FY91-96 Funding ($000)
JSC	Support to the Engineering Directorate	VIII-15-101	1/1/94	63,000
KSC	Engineering Support Services	VIII-15-100	3/1/92	26,000
KSC	Maintenance of Honeywell Computers	VIII-15-088	10/10/93	6,000
LRC	Scientific Computer Operations	VIII-15-090	8/1/92	27,000
MSFC	Program Support Communications Network	VIII-15-073	3/1/93	216,000
MSFC	Computational Mission Service	VIII-15-091	10/1/96	*
SSFC	Test Operations and Support	VIII-15-093	11/1/92	150,000

*Funding unknown

NASA Information Services Market Interview Profiles

A
NASA Agency Interviews

Recent interviews were conducted (in December 1991) with three NASA IRM executives. The interviews were conducted on-site at NASA Headquarters. Another separate interview was conducted via telephone with the Space Station Program's program manager.

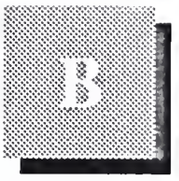
Interviews in 1987 were conducted by telephone for 90% of the agency respondents and the remaining 10% were on-site contacts at NASA Headquarters. The respondents interviewed within NASA included administrative policy officials, contracting officers, and program managers.

The following is a list of NASA and GSA offices interviewed:

- Goddard Space Flight Center (3)
- Ames Research Center (2)
- Jet Propulsion Laboratories
- Langley Research Center
- Kennedy Space Center
- Marshall Space Flight Center (2)
- Lewis Research Center
- Johnson Space Center
- Stennis Space Center
- NASA Headquarters (Code TS)
- NASA Headquarters (Code NTD) (3)
- NASA Headquarters (Code R)
- NASA Headquarters (Code NT)
- General Services Administration (Code KMAS)

B
Industry Interviews

INPUT did not conduct industry interviews for this revision. In 1987, INPUT contacted a representative sample of vendors that provide information services to NASA. Job classifications among individual vendor respondents included marketing and administrative executives. All contacts with vendor personnel were made by telephone.



Definitions

The definitions in this appendix include hardware, software, services, and telecommunications categories to accommodate the range of information systems and services programs described in this report.

Alternate service mode terminology employed by the federal government in its procurement process is defined along with INPUT's regular terms of reference, as shown in Exhibit B-1.

The federal government's unique, non-technical terminology, associated with applications, documentation, budgets, authorization, and the procurement/acquisition process, is included in Appendix C, Glossary of Federal Acronyms.

A
Overall Definitions and Analytical Framework

Information Services - Computer/telecommunications-related products and services that are oriented toward the development or use of information systems. Information services typically involve one or more of the following:

- Processing of specific applications using vendor-provided systems (called *Processing Services*)
- A combination of hardware, packaged software and associated support services which will meet a specific application processing need (called *Turnkey Systems*)
- Packaged software (called *Software Products*)
- People services that support users in developing and operating their own information systems (called *Professional Services*)
- Bundled combinations of products and services where the vendor assumes responsibility for the development of a custom solution to an information system problem (called *Systems Integration*)

- Services that provide operation and management of all or a significant part of a user's information systems functions under a long-term contract (called *Systems Operations)*

- Services associated with the delivery of information in electronic form—typically network-oriented services such as value-added networks, electronic mail and document interchange, on-line data bases, on-line news and data feeds, videotex, etc. (called *Network Services*)

In general, the market for information services does not involve providing equipment to users. The exception is where the equipment is bundled as part of an overall service offering such as a turnkey system, a systems operations contract, or a systems integration project.

The information services market also excludes pure data transport services (i.e., data or voice communications circuits). However, where information transport is associated with a network-based service (e.g., EDI or VAN services), or cannot be feasibly separated from other bundled services (e.g., some systems operations contracts), the transport costs are included as part of the services market.

The analytical framework of the *Information Services Industry* consists of the following interacting factors: overall and industry-specific business environment (trends, events and issues); technology environment; user information system requirements; size and structure of information services markets; vendors and their products, services and revenues; distribution channels, and competitive issues.

All *Information Services Market* forecasts are estimates of *User Expenditures* for information services. When questions arise about the proper place to count these expenditures, INPUT addresses them from the user's viewpoint: expenditures are categorized according to what users perceive they are buying.

By focusing on user expenditures, INPUT avoids two problems which are related to the distribution channels for various categories of services:

- Double counting, which can occur by estimating total vendor revenues when there is significant reselling within the industry (e.g., software sales to turnkey vendors for repackaging and resale to end users)

- Missed counting, which can occur when sales to end users go through indirect channels such as mail order retailers.

Delivery Modes are defined as specific products and services that satisfy a given user need. While *Market Sectors* specify *who* the buyer is, *Delivery Modes* specify *what* the user is buying.

Of the eight delivery modes defined by INPUT, five are considered primary products or services:

- Processing Services
- Network Services
- Professional Services
- Applications Software Products
- Systems Software Products

The remaining three delivery modes represent combinations of these products and services, bundled together with equipment, management and/or other services.

- Turnkey Systems
- Systems Operations
- Systems Integration

Section B describes the delivery modes and their structure in more detail.

Outsourcing is defined as the contracting of information systems (IS) functions to outside vendors. Outsourcing should be viewed as the opposite of *insourcing*: anything that IS management has considered feasible to do internally (e.g., data center operations, applications development and maintenance, network management, training, etc.) is a potential candidate for outsourcing.

IS has always bought systems software, as it is infeasible for companies to develop it internally. However, all other delivery modes represent functions or products that IS management could choose to perform or develop in-house. Viewed this way, outsourcing is the result of a make-or-buy decision, and the outsourcing market covers any product or service where the vendor must compete against the client firm's own internal resources.

B

Industry Structure and Delivery Modes

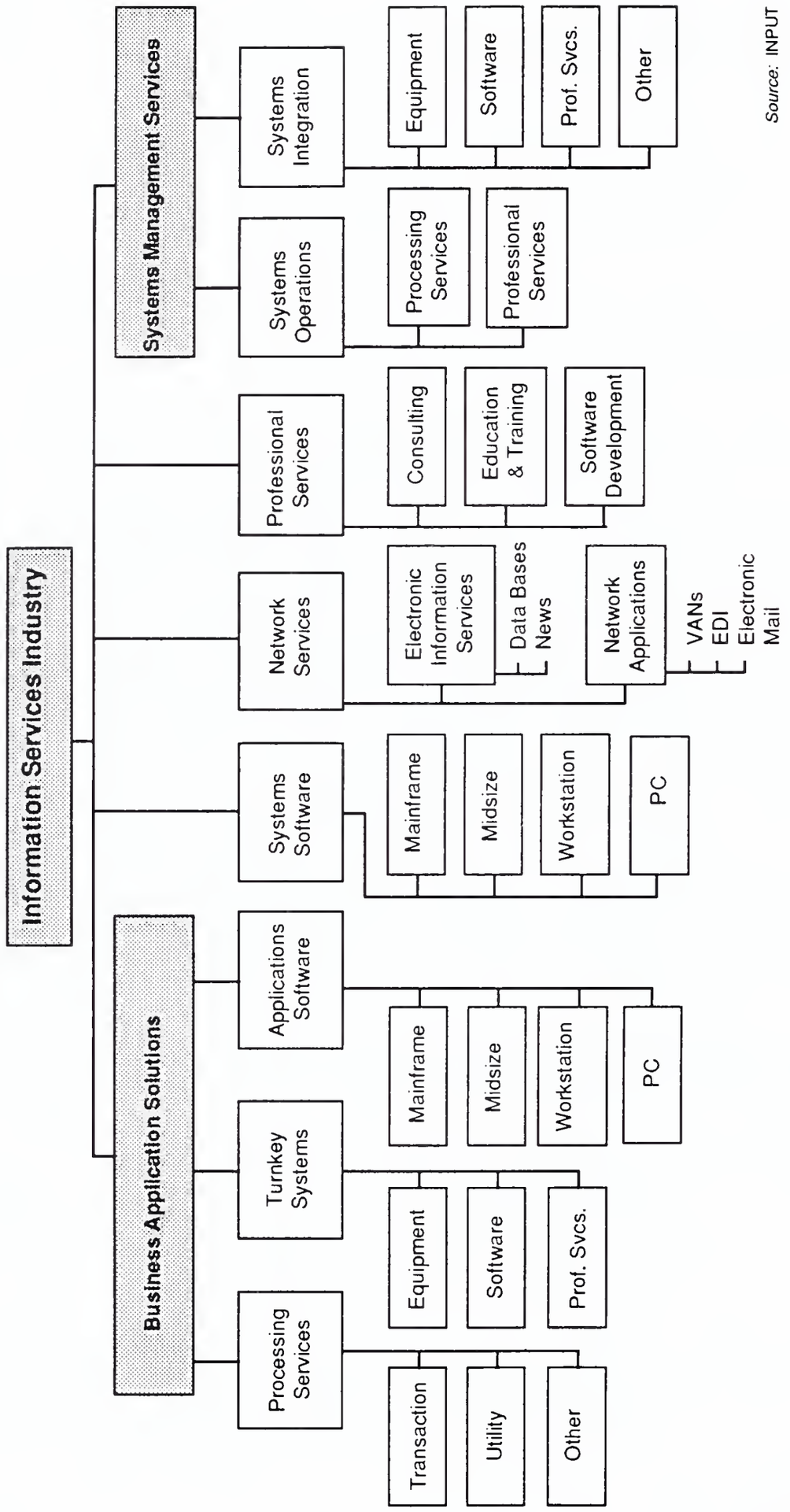
1. Services Categories

Exhibit B-1 presents the structure of the information services industry. Several of the delivery modes can be grouped into higher-level *Service Categories,* based on the kind of problem the user needs to solve. These categories are:

- *Business Application Solutions (BAS)* - prepackaged or standard solutions to common business applications. These applications can be either industry-specific (e.g., mortgage loan processing for a bank), cross-industry (e.g., payroll processing), or generic (e.g., utility time

EXHIBIT B-1

Information Services Industry Structure—1991



Source: INPUT

sharing). In general, BAS services involve minimal customization by the vendor, and allow the user to handle a specific business application without having to develop or acquire a custom system or system resources. The following delivery modes are included under BAS:

- Processing Services
- Applications Software Products
- Turnkey Systems

- *Systems Management Services (SMS)* - services which assist users in developing systems or operating/managing the information systems function. Two key elements of SMS are the customization of the service to each individual user and/or project, and the potential for the vendor to assume significant responsibility for management of at least a portion of the user's information systems function. The following delivery modes are included under SMS:

  - Systems Operations
  - Systems Integration

Each of the remaining three delivery modes represent a separate service category:

- Professional Services
- Network Services
- Systems Software Products

Note: These service categories are a new concept introduced in 1990. They are purely an aggregation of lower-level delivery mode data. They do not change the underlying delivery modes or industry structure.

2. Software Products

There are many similarities between the applications and systems software delivery modes. Both involve user purchases of software packages for in-house computer systems. Included are both lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's site. Vendor-provided training or support in operation and user of the package, if bundled in the software pricing, is also included here.

Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

Software products have several subcategories, as indicated below and shown in Exhibit B-2.

- Systems Software Products

  Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products include:

  - *Systems Control Products* - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.

  - *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

  - *Applications Development Tools* - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base management systems, report writers, project control systems, CASE systems, and other development productivity aids. Also included are system utilities (e.g., sorts) which are directly invoked by an applications program.

- Applications Software Products

  - *Industry-Specific Applications Software Products* - Software products that perform functions related to solving business or organizational needs unique to a specific vertical market and sold to that market only. Examples include demand deposit accounting, MRPII, medical recordkeeping, automobile dealer parts inventory, etc.

  - *Cross-Industry Applications Software Products* - Software products that perform a specific function that is applicable to a wide range of industry sectors. Applications include payroll and human resource systems, accounting systems, word processing and graphics systems, spreadsheets, etc.

EXHIBIT B-2

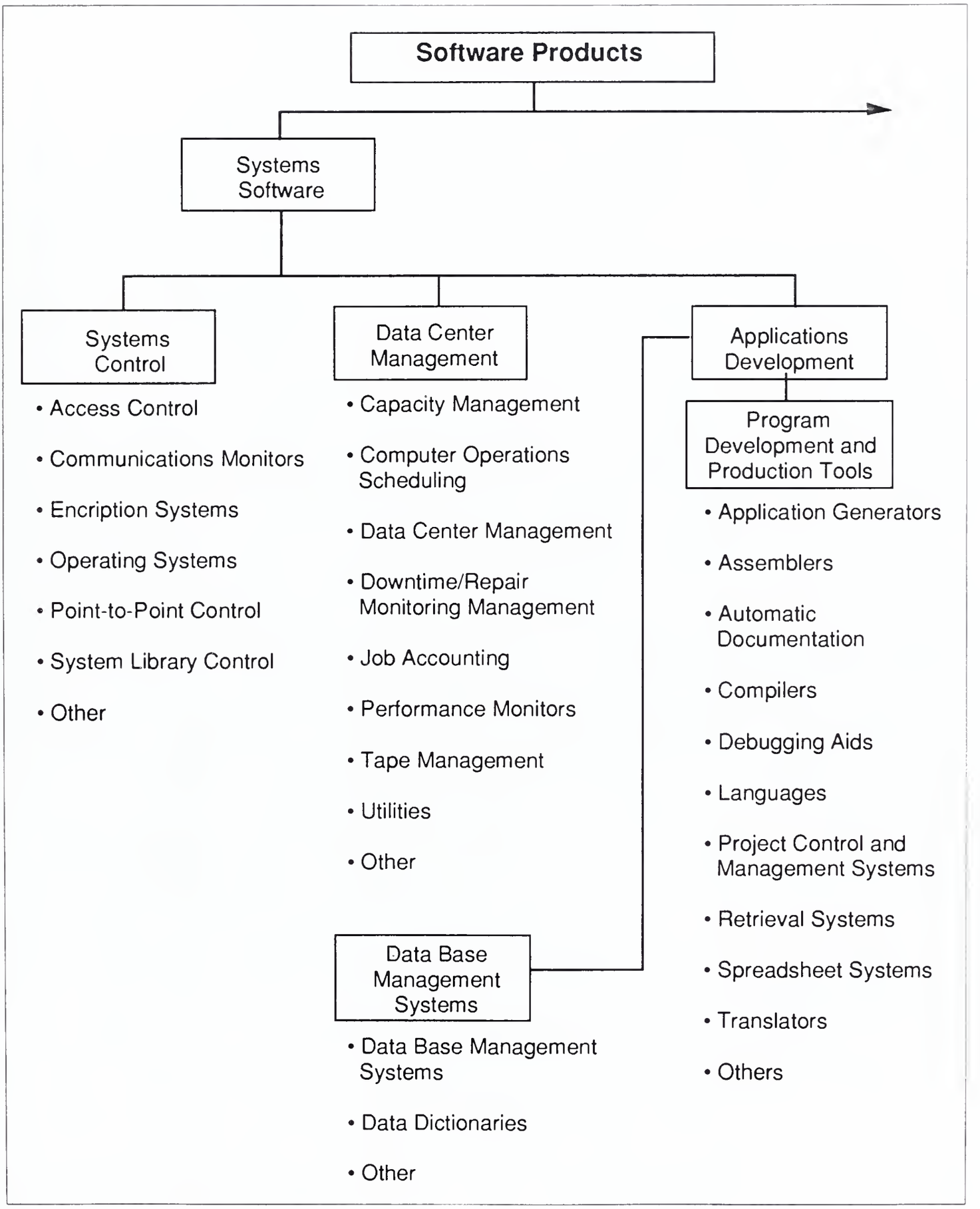
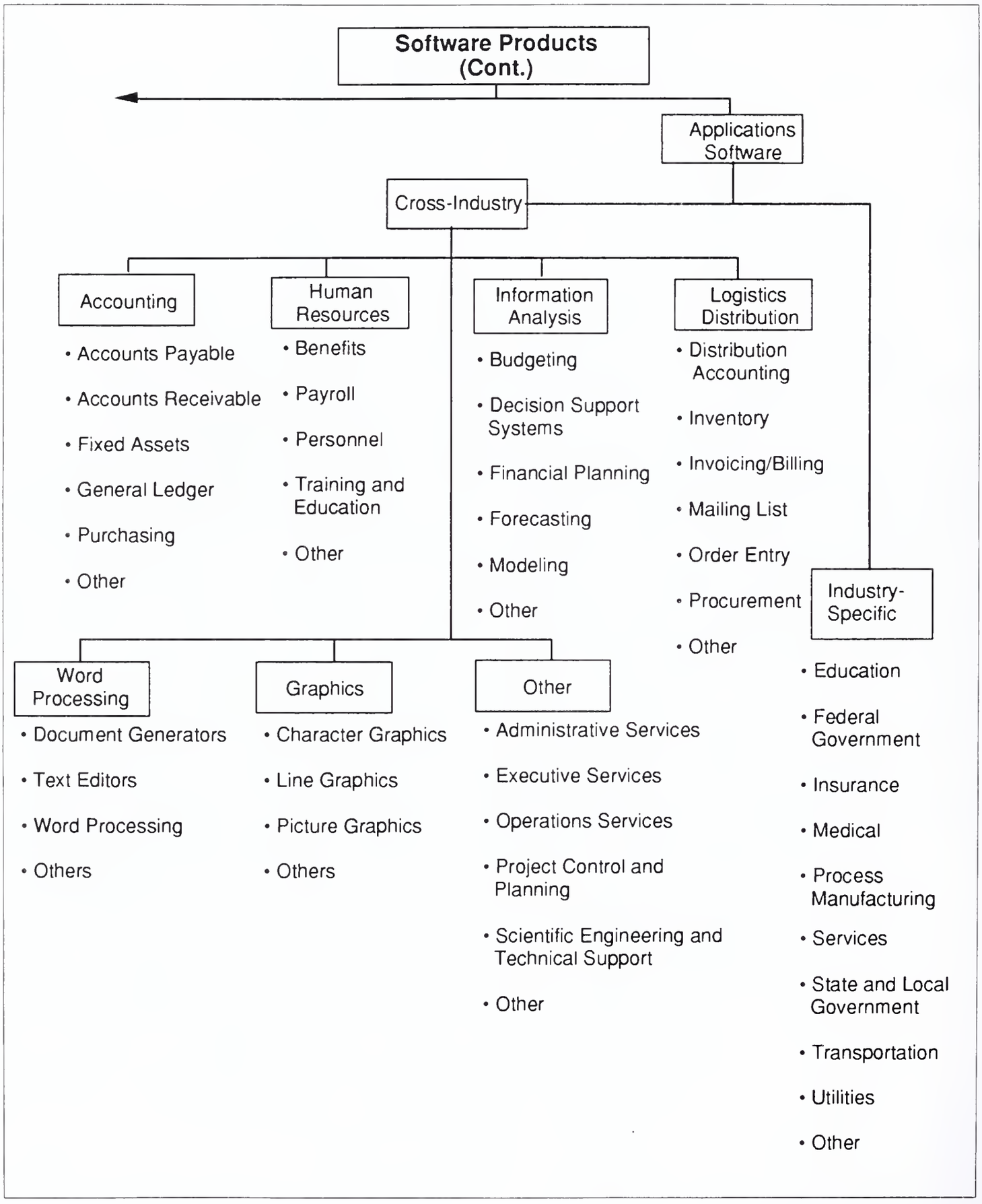


EXHIBIT B-2 (CONT.)



3. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom application software into a single system developed to meet a specific set of user requirements. Value added by the turnkey system vendor is primarily in the software and support services provided. Most CAD/CAM systems and many small business systems are turnkey systems. Turnkey systems utilize standard computer and do not include specialized hardware such as word processors, cash registers, process control systems, or embedded computer systems for military applications.

Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.

Most turnkey systems are sold through channels known as value-added resellers.

- Value-Added Reseller (VAR): A VAR adds value to computer hardware and/or software and then resells it to an end user. The major value added is usually application software for a vertical or cross-industry market, but also includes many of the other components of a turnkey systems solution, such as professional services.

Turnkey systems are divided into two categories:

- *Industry-Specific Systems* - systems that serve a specific function for a given industry sector, such as automobile dealer parts inventory, medical recordkeeping, or discrete manufacturing control systems.

- *Cross-Industry Systems* - systems that provide a specific function that is applicable to a wide range of industry sectors, such as financial planning systems, payroll systems, or personnel management systems.

4. Processing Services

This category includes transaction processing, utility processing, and other processing services.

- *Transaction Processing*: Client uses vendor-provided information systems—including hardware, software and/or data networks—at vendor site or customer site to process transactions and update client data bases. Transactions may be entered in one of four modes:

- *Interactive* - Characterized by the interaction of the users with the system for data entry, transaction processing, problem solving and report preparation: the user is on-line to the programs/files stored on the vendor's system.

- *Remote Batch* - Where the user transmits batches of transaction data to the vendor's system, allowing the vendor to schedule job execution according to overall client priorities and resource requirements.

- *Distributed Services* - Where users maintain portions of an application data base and enter or process some transaction data at their own site, while also being connected through communications networks to the vendor's central systems for processing other parts of the application.

- *Carry-in Batch* - where users physically deliver work to a processing services vendor.

- *Utility Processing:* Vendor provides basic software tools (language compilers, assemblers, DBMSs, graphics packages, mathematical models, scientific library routines, etc.), generic applications programs and/or data bases, enabling clients to develop their own programs or process data on vendor's system.

- *Other Processing Services:* Vendor provides services—usually at vendor site—such as scanning and other data entry services, laser printing, computer output microfilm (COM), CD preparation and other data output services, backup and disaster recovery, etc.

5. Systems Operations

Systems operations involves the operation and management of all or a significant part of the user's information systems functions under a long-term contract. These services can be provided in either of two distinct submodes:

- *Professional Services:* The vendor provides personnel to operate client-supplied equipment. Prior to 1990, this was a submode of the Professional Services delivery mode.

- *Processing Services:* The vendor provides personnel, equipment and (optionally) facilities. Prior to 1990, this was a submode of the Processing Services delivery mode.

Systems operations vendors now provide a wide variety of services in support of existing information systems. The vendor can plan, control, provide, operate, maintain and manage any or all components of the user's information systems (equipment, networks, systems and/or application software), either at the client's site or the vendor's site. Systems operations can also be referred to as "resource management" or "facilities management".

There are two general levels of systems operations:

- Platform/network operations - where the vendor operates the computer system and/or network without taking responsibility for the applications
- Application operations - where the vendor takes responsibility for the complete system, including equipment, associated telecommunications networks, and applications software.

Note: Systems Operations is a new delivery mode introduced in 1990.

6. Systems Integration (SI)

Systems integration is a business offering that provides a complete solution to an information system, networking or automation requirements through the custom selection and implementation of a variety of information system products and services. A systems integrator is responsible for the overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for the delivery of the specified system function, on schedule and at the contracted price.

To be included in the information services market, systems integration projects must involve some application processing component. In addition, the majority of cost must be associated with information systems products and/or services.

The systems integrator will perform, or manage others who perform, most or all of the following functions:

- Program management, including subcontractor management
- Needs analysis
- Specification development
- Conceptual and detailed systems design and architecture
- System component selection, modification, integration and customization

- Custom software design and development
- Custom hardware design and development
- Systems implementation, including testing, conversion and post-implementation evaluation and tuning
- Life cycle support, including
  - System documentation and user training
  - Systems operations during development
  - Systems maintenance
- Financing

7. Professional Services

This category includes consulting, education and training, and software development.

- *Consulting:* services include management consulting (related to information systems), information systems consulting, feasibility analysis and cost-effectiveness studies, and project management assistance. Services may be related to any aspect of information systems, including equipment, software, networks and systems operations.
- *Education and Training*: Products and services related to information systems and services for the professional end user, including computer-aided instruction, computer-based education, and vendor instruction of user personnel in operations, design, programming, and documentation.
- *Software Development*: Services include user requirements definition, systems design, contract programming, documentation and implementation of software performed on a custom basis. Conversion and maintenance services are also included.

8. Network Services

Network services typically include a wide variety of network-based functions and operations. Their common thread is that most of these functions could not be performed without network involvement. Network services is divided into two major segments: Electronic Information Services, which involve selling information to the user, and Network Applications, which involve providing some form of enhanced transport service in support of a user's information processing needs.

- Electronic Information Services

Electronic information services are data bases that provide specific information via terminal- or computer-based inquiry, including items such as stock prices, legal precedents, economic indicators, periodical literature, medical diagnosis, airline schedules, automobile valuations, etc. The terminals used may be computers themselves, such as communications servers or personal computers. Users typically inquire into and extract information from the data bases. Although users may load extracted data into their own computer systems, the electronic information vendor provides no data processing or manipulation capability and the users cannot update the vendor's data bases.

The two kinds of electronic information services are:

- *On-line Data Bases* - Structured, primarily numerical data on economic and demographic trends, financial instruments, companies, products, materials, etc.

- *News Services* - Unstructured, primarily textual information on people, companies, events, etc.

While electronic information services have traditionally been delivered via networks, there is a growing trend toward the use of CD ROM optical disks to support or supplant on-line services, and these optical disk-based systems are included in the definition of this delivery mode.

- *Network Applications*

  - *Value-Added Network Services (VAN Services)* - VAN services are enhanced transport services which involve adding such functions as automatic error detection and correction, protocol conversion, and store-and-forward message switching to the provision of basic network circuits.

While VAN services were originally provided only by specialized VAN carriers (Tymet, Telenet, etc.), today these services are also offered by traditional common carriers (AT&T, Sprint, etc.). Meanwhile, the VAN carriers have also branched into the traditional common carriers' markets and are offering unenhanced basic network circuits as well.

INPUT's market definition covers VAN services only, but includes the VAN revenues of all types of carriers.

- *Electronic Data Interchange (EDI)* - Application-to-application exchange of standardized business documents between trade partners or facilitators. This exchange is commonly performed using VAN services. specialized translation software is typically employed to convert data from organizations' internal file formats to EDI interchange standards; this software may be provided as part of the VAN service, or may be resident on the organization's own computers.

- *Electronic Information Exchange (EIE)* - Also known as Electronic Mail (E-Mail), EIE involves the transmission of messages across an electronic network managed by a services vendor, including facsimile transmission (FAX), voice mail, voice messaging, and access to Telex, TWX, and other messaging services. This also includes bulletin board services.

- *Other Network Services* - This segment contains videotex and pure network management services. Videotex is actually more a delivery mode than an application. Its prime focus is on the individual as a consumer or in business. These services provide interactive access to data bases and offer the inquirer the capability to send as well as receive information for such purposes as home shopping, home banking, travel reservations, and more.

Network management services included here must involve the vendor's network and network management systems as well as people. People-only services, or services that involve the management of networks as part of the broader task of managing a user's information processing functions are included in Systems Operations.

C
Hardware/Hardware Systems

Hardware - Includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system.

- *Peripherals* - Includes all input, output, communications, and storage devices (other than main memory) that can be connected locally to the main processor, and generally cannot be included in other categories such as terminals.

- *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters.

- *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics, and plotters

- *Communication Devices* - Includes modem, encryption equipment, special interfaces, and error control

- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories

Terminals - Three types of terminals are described below:

- *User Programmable* - Also called intelligent terminals, including the following:

  - Single-station or standalone
  - Multistation, shared processor
  - Teleprinter
  - Remote batch

- User Nonprogrammable

  - Single-station
  - Multistation, shared processor
  - Teleprinter

- *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access, and other applications

Hardware Systems - Includes all processors from microcomputers to supercomputers. Hardware systems may require type- or model-unique operating software to be functional, but this category excludes applications software and peripheral devices, other than main memory and processors or CPUs not provided as part of an integrated (turnkey) system.

- *Microcomputer* - Combines all of the CPU, memory, and peripheral functions of an 8-, 16-, or 32-bit computer on a chip in various forms including:

  - Integrated circuit package

  - Plug-in boards with increased memory and peripheral circuits

  - Console including keyboard and interfacing connectors

  - Personal computer with at least one external storage device directly addressable by the CPU

  - An embedded computer which may take a number of shapes or configurations

- *Workstations* - High-performance, desktop, single-user computers employing (mostly) Reduced Instruction Set Computing (RISC). Workstations provide integrated, high-speed, local network-based services such as data base access, file storage and back-up, remote communications, and peripheral support. Typical workstation products are provided by Apollo (now a unit of Hewlett-Packard), Sun, Altos, DEC (the MicroVAX) and IBM. These products usually cost more than $15,000. However, at this writing many companies have recently announced sizable price cuts.

- *Midsize Systems* - Describe superminicomputers and the more traditional business minicomputers. Due to steadily improving design and technology, the latter have outgrown traditional definitions (which defined small systems as providing 32-bit to 64-bit word lengths at prices ranging from $15,000 to $350,000). Increasingly, minicomputers and workstations meet the 32-bit definition, and may go beneath the $15,000 lower price limit. Typical midrange systems include IBM System/3X, 43XX, AS/400, and 937X product lines, DEC PDP and VAX families (excluding MicroVAX families), and competitive products from a wide range of vendors, including HP, Data General, Wang, AT&T, Prime Concurrent, Gould, Unisys, NCR, Bull, Harris, Tandem, Stratus, and many others.

- *Large Computer* - Presently centered on storage controllers, but likely to become bus-oriented and to consist of multiple processors or parallel processor. Intended for structured mathematical and signal processing and typically used with general purpose, Von Neumann-type processors for system control. This term usually refers to traditional mainframes and supercomputers.

- *Supercomputer* - High-powered processors with numerical processing throughput that is significantly greater than the fastest general purpose computers, with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes over 500 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-four gigabyte class, are labeled Class V to Class VII in agency long-range plans. Supercomputers fit in one of two categories:

  - Real Time - Generally used for signal processing in military applications

  - Non-Real Time - For scientific use in one of three configurations:

    · Parallel processors
    · Pipeline processor
    · Vector processor

  - *Supercomputer* - Is also applied to micro, mini, and large mainframe computers with performance substantially higher than attainable by Von Neumann architectures.

- *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform; critical to a military or intelligence mission such as command and control, cryptological activities, or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or

semipermanent interfaces. These systems may vary in capacity from microcomputers to parallel processor computer systems.

D
General Definitions

Analog - Signal or transmission type with continuous waveform representation.

ASCII - American National Standard Code for Information Interchange—Eight-bit code with seven data bits and one parity bit.

Asynchronous - Communications operation (such as transmission) without continuous timing signals. Synchronization is accomplished by appending signal elements to the data.

Bandwidth - Range of transmission frequencies that can be carried on a communications path; used as a measure of capacity.

Baud - Number of signal events (discrete conditions) per second. Typically used to measure modem or terminal transmission speed.

Byte - Usually equivalent to the storage required for one alphanumeric character (i.e., one letter or number).

CBX - Computerized Branch Exchange—A PABX based on a computer system, implying programmability and usually voice and data capabilities.

Central Processing Unit (CPU) - The arithmetic and control portion of a computer; i.e., the circuits controlling the interpretation and execution of computer instructions.

Centrex - Central office telephone services that permit local circuit switching without installation of customer premises equipment. Could be described as shared PBX service.

Circuit Switching - A process that, usually on demand, connects two or more network stations, and permits exclusive circuit use until the connection is released; typical of the voice telephone network, where a circuit is established between the caller and the called party.

CO - Central Office—Local telco site for one or more exchanges.

CODEC - Coder/decoder—Equivalent to modem for digital devices.

Constant Dollars - Growth forecasts in constant dollars make no allowance for inflation or recession. Dollar value based on the year of the forecast unless otherwise indicated.

Computer System - The combination of computing resources required to perform the designed functions. May include one or more CPUs, machine room peripherals, storage systems, and/or applications software.

CPE - Customer Premises Equipment—DCE or DTE located at a customer site rather than at a carrier site such as the local telephone company CO. May include switchboards, PBX, data terminals, and telephone answering devices.

CSMA/CD - Carrier Sense Multiple Access/Collision Detect—Contention protocol used in local-area networks, typically with a multipoint configuration.

Current Dollars - Estimates or values expressed in current-year dollars which, for forecasts, would include an allowance for inflation.

Data Encryption Standard (DES) - Fifty-six-bit key, one-way encryption algorithm adopted by NIST in 1977, implemented through hardware ("S-boxes") or software. Designed by IBM with NSA guidance.

Datagram - A self-contained packet of information that does not depend on the contents of preceding or following packets and has a finite length.

DCA - IBM's Document Content Architecture—Protocols for specifying document (text) format which are consistent across a variety of hardware and software systems within IBM's DISOSS.

DCE - Data Circuit-terminating Equipment—Interface hardware that couples DTE to a transmission circuit or channel by providing functions to establish, maintain, and terminate a connection, including signal conversion and coding.

DDCMP - Digital Data Communications Message Protocol—Data link protocol used in Digital Equipment Company's DECNET.

DECNET - Digital Equipment Company's network architecture.

Dedicated Circuit - A permanently established network connection between two or more stations; contrast with switched circuit.

DEMS - Digital Electronic Message Service—Nationwide common carrier digital networks which provide high-speed, end-to-end, two-way transmission of digitally encoded information using the 10.6 GHz band.

DIA - IBM's Document Interchange Architecture—Protocols for transfer of documents (text) between different hardware and software systems within IBM's DISOSS.

Digital - Signal or transmission type using discontinuous, discrete quantities to represent data.

DISOSS - IBM's DIStributed Office Support System—Office automation environment, based on DCA and DIA, which permits document (text) transfer between different hardware and software systems without requiring subsequent format or content revision.

Distributed Data Processing - The development of programmable intelligence in order to perform a data processing function where it can be accomplished most effectively through computers and terminals arranged in a telecommunications network adapted to the user's needs.

DTE - Data Terminal Equipment—Hardware which is a data source, link, or both, such as video display terminals that convert user information into data transmission, and reconvert data signals into user information.

EBCDIC - Extended Binary Coded Decimal Interchange Code—Eight-bit code typically used in IBM mainframe environments.

EFT - Electronic funds transfer.

Encryption - Electric, code-based conversion of transmitted data to provide security and/or privacy of data between authorized access points.

End User - One who is using a product or service to accomplish his or her own functions. The end user may buy a system from the hardware supplier(s) and do his or her own programming, interfacing, and installation. Alternately, the end user may buy a turnkey system from a systems house or hardware integrator, or may buy a service from an in-house department or external vendor.

Engineering Change Notice (ECN) - Product improvements after production.

Engineering Change Order (ECO) - The follow-up to ECNs, including parts and a bill of materials to effect the change in the hardware.

Equipment Operators - Individuals operating computer control consoles and/or peripheral equipment (BLS definition).

Erasable Disk - A type of disk that allows users to erase data previously written. Erasable disks used for applications where data may need to be updated periodically.

Ethernet - Local-area network developed by Xerox PARC using baseband signaling, CSMA/CD protocol, and coaxial cable to achieve a 10 mbps data rate.

Facsimile - Transmission and reception of graphic data, usually fixed images of documents, through scanning and conversion of a picture signal.

FDM - Frequency Division Multiplexing—A multiplexing method that permits multiple access by assigning different frequencies of the available bandwidth to different channels.

FEP - Front-End Processor—Communications concentrator such as the IBM 3725 or COMTEN 3690 used to interface communications lines to host computers.

Field Engineer (FE) - Field engineer, customer engineer, serviceperson, and maintenance person are used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

Full-Duplex - Bi-directional communications, with simultaneous, two-way transmission.

General Purpose Computer System - A computer designed to handle a wide variety of problems. Includes machine room peripherals, systems software, and small business systems.

Half-Duplex - Bi-directional communications, but only in one direction at a time.

Hardware Integrator - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. The hardware integrator also may develop control system software in addition to installing the entire system at the end-user site.

HDLC - High-level Data Link Control.

Hertz- Number of signal oscillations (cycles) per second, abbreviated Hz.

IBM Token Ring - IBM's local-area network using baseband signalling and operating at 4 mbps on twisted-pair copper wire. Actually a combination of star and ring topologies—IEEE 802.5-compatible.

IDN - Integrated Digital Network—Digital switching and transmission; part of the evolution to ISDN.

Independent Suppliers - Suppliers of machine room peripherals, though usually not suppliers of general purpose computer systems.

Information Processing - Data processing as a whole, including use of business and scientific computers.

Installed Base - Cumulative number or value (cost when new) of computers in use.

Interconnection - Physical linkage between devices on a network.

Interoperability - The capability to operate with other devices on a network. Different from interconnection, which merely guarantees a physical network interface.

ISDN - Integrated Services Digital Network—Completely digital, integrated voice and nonvoice public network service. Not clearly defined through any existing standards, although FCC and other federal agencies are developing CCITT recommendations.

Keypunch Operators - Individuals operating keypunch machines (similar to electric typewriters) to transcribe data from source materials onto punch cards.

Lease Line - Permanent connection between two network stations. Also known as dedicated or non-switched line.

Machine Repairers - Individuals who install and periodically service computer systems.

Machine Room Peripherals - Peripheral equipment generally located close to the central processing unit.

Mainframe - The central processing unit (CPU or units in a parallel processor) of a computer that interprets and executes computer (software) instructions of 32 bits or more.

MAP - Manufacturing Automation Protocol—Seven-layer communications standard for factory environments promoted by General Motors/ EDS. Adopts IEEE 802.2 and IEEE 802.4 standards plus OSI protocols for other layers of the architecture.

Mean Time to Repair - The mean of elapsed times from the arrival of the field engineer on the user's site to the time when the device is repaired and returned to user service.

Mean Time to Respond - The mean of elapsed times from the user call for services and the arrival of the field engineer on the user's site.

Message - A communication intended to be read by a person. The quality of the received document need not be high, only readable. Graphic materials are not included.

MMFS - Manufacturing Messaging Format Standard—Application-level protocol included within MAP.

Modem - A device that encodes information into electronically transmittable form (MOdulator) and restores it to original analog form (DEModulator).

NCP - Network Control Program—Software used in IBM 3705/3725 FEPs for control of SNA networks.

Node - Connection point of three or more independent transmission points which may provide switching or data collection.

Off-Line - Pertaining to equipment or devices that can function without direct control of the central processing unit.

On-Line - Pertaining to equipment or devices under direct control of the central processing unit.

Optical Disk - Storage device that uses laser technology to record data. Optical disks provide high storage capacity, but cannot be overwritten.

OSI - ISO reference model for Open Systems Interconnection—Seven-layer architecture for application, presentation, session, transport, network, data link, and physical services and equipment.

OSI Application Layer - Layer 7, providing end-user applications services for data processing.

OSI Data Link Layer - Layer 2, providing transmission protocols, including frame management, link flow control, and link initiation/release.

OSI Network Layer - Layer 3, providing call establishment and clearing control through the network nodes.

OSI Physical Layer - Layer 1, providing the mechanical, electrical, functional, and procedural characteristics to establish, maintain, and release physical connections to the network.

OSI Presentation Layer - Layer 6, providing data formats and information such as data translation, data encoding/decoding, and command translation.

OSI Session Layer - Layer 5, establishes, maintains, and terminates logical connections for the transfer of data between processes.

OSI Transport Layer - Layer 4, providing end-to-end terminal control signals such as acknowledgments.

Overseas - Not within the geographical limits of the continental United States, Alaska, Hawaii, and U.S. possessions.

PABX - Private Automated Branch Exchange—Hardware that provides automatic (electro-mechanical or electronic) local circuit switching on a customer's premises.

PAD - Packet Assembler-Disassembler—A device that enables DTE not equipped for packet switching operation to operate on a packet switched network.

PBX - Private Branch Exchange—Hardware that provides local circuit switching on the customer premise.

PCM - Pulse-Code Modulation—Modulation involving conversion of a waveform from analog to digital form through coding.

PDN - Public Data Network—A network established and operated by a recognized private operating agency, a telecommunications administration, or other agency for the specific purpose of providing data transmission services to the public.

Peripherals - Any unit of input/output equipment in a computer system, exclusive of the central processing unit.

PPM - Pulse Position Modulation.

Private Network - A network established and operated for one user or user organization.

Programmers - Persons mainly involved in designing, writing, and testing computer software programs

Protocols - The rules for communication system operation that must be followed if communication is to be effected. Protocols may govern portions of a network or service. In digital networks, protocols are digitally encoded as instructions to computerized equipment.

Public Network - A network established and operated for more than one user with shared access, usually available on a subscription basis. See related international definition of PDN.

Read-Only - A type of disk that is prerecorded and can be used for retrieving data. A read-only disk cannot be overwritten. A read-only system will retrieve and display stored data, but the system cannot alter the stored data.

Read/Write - A type of disk that can be read and written upon. A read/write system will read and display stored data and alter data already recorded.

Scientific Computer System - A computer system designed to process structured mathematics (such as Fast Fourier Transforms), and complex, highly redundant information (such as seismic data, sonar data, and radar), with large, on-line memories and very high-capacity output.

SDLC - Synchronous Data Link Control—IBM's data link control for SNA. Supports a subset of HDLC modes.

SDN - Software-Defined Network.

Security - Physical, electrical, and computer (digital) coding procedures to protect the contents of computer files and data transmission from inadvertent or unauthorized disclosure to meet the requirements of the Privacy Act and national classified information regulations

Service Delivery Point - The location of the physical interface between a network and customer/user equipment

Simplex - Unidirectional communications.

Smart Box - A device for adapting existing DTE to new network standards such as OSI. Includes PADs and protocol convertors, for example.

SNA - Systems Network Architecture—Seven-layer communications architecture designed by IBM. Layers correspond roughly but not exactly to OSI model.

Software - Computer programs

Supplies - Includes materials associated with the use of operations of computer systems, such as printer paper, keypunch card, disk packs, and tapes.

Switched Circuit - Temporary connection between two network stations established through dial-up procedures.

Synchronous - Communications operation with separate, continuous clocking at both sending and receiving stations.

Systems Analyst - Individual who analyzes problems to be converted to a programmable form for application to computer systems.

Systems House - Vendor that acquires, assembles, and integrates hardware and software into a total system to satisfy the data processing requirements of an end user. The vendor also may develop systems software products for license to end users. The systems house vendor does not manufacture mainframes.

Systems Integrator - Systems house vendor that develops systems interface electronics, applications software, and controllers for the CPU, peripherals, and ancillary subsystems which may have been provided by a contractor or the government (GFE). This vendor may either supervise or perform the installation and testing of the completed system.

T1 - Bell System designation for 1.544 mbps carrier capable of handling 24 PCM voice channels.

TDM - Time Division Multiplexing—A multiplexing method that interleaves multiple transmissions on a single circuit by assigning a different time slot to each channel.

Token Passing - Local-area network protocol which allows a station to transmit only when it has the "token," an empty slot on the carrier.

TOP - Technical Office Protocol—Protocol developed by Boeing Computer Services to support administrative and office operations as complementary functions to factory automation implemented under MAP.

Turnkey System - System composed of hardware and software integrated into a total system designed to fulfill completely the processing requirements of a single application.

Twisted-Pair Cable - Communications cabling consisting of pairs of single-strand metallic electrical conductors, such as copper wires, typically used in building telephone wiring and some LANs.

Verification and Validation - Process for examining and testing applications and special systems software to verify that it operates on the target CPU and performs all of the functions specified by the user.

Voice-Grade - Circuit or signal in the 300-3300 Hz bandwidth typical of the public telephone system, nominally a 4 Khz user.

VTAM - Virtual Telecommunications Access Method—Host-resident communications software for SNA networks.

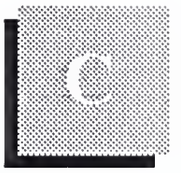
WORM - Write-Once, Read-Many—A type of disk that can be created one time. Once written on, the disk can only be read—otherwise data will be destroyed.

Write-Once - A type of disk that can be created one time. Once written on, the disk can only be read. It cannot be rewritten.

E

Other Considerations

When questions arise as to the proper place to count certain user expenditures, INPUT addresses the questions from the user viewpoint. Expenditures are then categorized according to the users' perception of the purchase.



Glossary of Acronyms

The federal government's procurement language uses a combination of acronyms, phrases, and words that is complicated by different agency definitions and interpretations. The government also uses terms of accounting, business, economics, engineering, and law with new applications and technology.

Acronyms and contract terms that INPUT encountered most often in program documentation and interviews for this report are included here, but this glossary should not be considered all-inclusive. Federal procurement regulations (DAR, FPR, FAR, FIRMR, FPMR) and contract terms listed in RFIs, RFPs, and RFQs provide applicable terms and definitions.

Federal agency acronyms have been included to the extent they are employed in this report.

A

Federal Acronyms

AAS	Automatic Addressing System.
AATMS	Advanced Air Traffic Management System.
ACO	Administrative Contracting Offices (DCAS).
ACS	Advanced Communications Satellite (formerly NASA 30/20 GHz Satellite Program).
ACT-1	Advanced Computer Techniques (Air Force).
Ada	DoD High-Order Language.
ADA	Airborne Data Acquisition.
ADL	Authorized Data List.
ADS	Automatic Digital Switches (DCS).
AFA	Air Force Association.
AFCEA	Armed Forces Communications Electronics Association.
AGE	Aerospace Ground Equipment.
AIP	Array Information Processing.

AIS	Automated Information System.
AMPE	Automated Message Processing Equipment.
AMPS	Automated Message Processing System.
AMSL	Acquisition Management Systems List.
ANG	Army National Guard
AP(P)	Advance Procurement Plan.
Appropriation	Congressionally approved funding for authorized programs and activities of the Executive Branch.
APR	Agency Procurement Request.
ARPANET	DARPA network of scientific computers.
ASP	Aggregated Switch Procurement.
ATLAS	Abbreviated Test Language for All Systems (for ATE-Automated Test Equipment).
Authorization	In the legislative process programs, staffing, and other routine activities must be approved by Oversight Committees before the Appropriations Committee will approve the money from the budget.
AUSA	Association of the U.S. Army.
AUTODIN	AUTOmatic DIgital Network of the Defense Communications System.
AUTOSEVOCOM	AUTOmatic SEcure VOice COMmunications Network.
AUTOVON	AUTOmatic VOice Network of the Defense Communications System.
BA	Basic Agreement.
BAFO	Best And Final Offer.
Base level	Procurement, purchasing, and contracting at the military installation level.
BCA	Board of Contract Appeals.
Benchmark	Method of evaluating ability of a candidate computer system to meet user requirements.
Bid protest	Objection (in writing, before or after contract award) to some aspect of a solicitation by a valid bidder.
BML	Bidders Mailing List - qualified vendor information filed annually with federal agencies to automatically receive RFPs and RFQs in areas of claimed competence.
BOA	Basic Ordering Agreement.
B&P	Bid and Proposal - vendor activities in response to government solicitation/specific overhead allowance.
BPA	Blanked Purchase Agreement.
Budget	Federal Budget, proposed by the President and subject to Congressional review.
C^2	Command and Control.
C^3	Command, Control, and Communications.
C^4	Command, Control, Communications, and Computers.
C^3I	Command, Control, Communications, and Intelligence.
CAB	Contract Adjustment Board or Contract Appeals Board.
CADE	Computer-Aided Design and Engineering.
CADS	Computer-Assisted Display Systems.
CAIS	Computer-Assisted Instruction System.
CALS	Computer-Aided Automated Logistic System.
CAPS	Command Automation Procurement Systems.

CAS	Contract Administration Services or Cost Accounting Standards.
CASB	Cost Accounting Standards Board.
CASP	Computer-Assisted Search Planning.
CBD	Commerce Business Daily - U.S. Department of Commerce publication listing government contract opportunities and awards.
CBO	Congressional Budget Office.
CCEP	Commercial Comsec Endorsement Program.
CCDR	Contractor Cost Data Reporting.
CCN	Contract Change Notice.
CCPDS	Command Center Processing and Display Systems.
CCPO	Central Civilian Personnel Office.
CCTC	Command and Control Technical Center (JCS).
CDR	Critical Design Review.
CDRL	Contractor Data Requirement List.
CFE	Contractor-Furnished Equipment.
CFR	Code of Federal Regulations.
CICA	Competition in Contracting Act.
CIG	Computerized Interactive Graphics.
CIR	Cost Information Reports.
CM	Configuration Management.
CMI	Computer-Managed Instruction.
CNI	Communications, Navigation, and Identification.
CO	Contracting Office, Contract Offices, or Change Order.
COC	Certificate of Competency (administered by the Small Business Administration).
COCO	Contractor-Owned, Contractor-Operated.
CODSIA	Council of Defense and Space Industry Associations.
COMSTAT	Communications Satellite Corporation.
CONUS	CONtinental United States.
COP	Capability Objective Package.
COTR	Contracting Officer's Technical Representative.
CP	Communications Processor.
CPAF	Cost-Plus-Award-Fee Contract.
CPFF	Cost-Plus-Fixed-Fee Contract.
CPIF	Cost-Plus-Incentive-Fee Contract.
CPR	Cost Performance Reports.
CPSR	Contractor Procurement System Review.
CR	Cost Reimbursement (Cost Plus Contract).
CSA	Combat or Computer Systems Architecture.
C/SCSC	Cost/Schedule Control System Criteria (also called "C-Spec").
CWAS	Contractor Weighted Average Share in Cost Risk.
DAL	Data Accession List.
DAR	Defense Acquisition Regulations.
DARPA	Defense Advanced Research Projects Agency.
DAS	Data Acquisition System.
DBHS	Data Base Handling System.
DCA	Defense Communications Agency.

DCAA	Defense Contract Audit Agency.
DCAS	Defense Contract Administration Services.
DCASR	DCAS Region.
DCC	Digital Control Computer.
DCP	Development Concept Paper (DoD).
DCS	Defense Communications System.
DCTN	Defense Commercial Telecommunications Network.
DDA	Dynamic Demand Assessment (Delta Modulation).
DDC	Defense Documentation Center.
DDL	Digital Data Link - A segment of a communications network used for data transmission in digital form.
DDN	Defense Data Network.
DDS	Dynamic Diagnostics System.
DECCO	DEfense Commercial Communications Office.
DECEO	DEfense Communications Engineering Office.
D&F	Determination and Findings - required documentation for approval of a negotiated procurement.
DIA	Defense Intelligence Agency.
DIF	Document Interchange Format, Navy-sponsored word processing standard.
DHHS	Department of Health and Human Services.
DIDS	Defense Integrated Data Systems.
DISC	Defense Industrial Supply Center.
DLA	Defense Logistics Agency.
DMA	Defense Mapping Agency.
DNA	Defense Nuclear Agency.
DO	Delivery Order.
DOA	Department of Agriculture (also USDA).
DOC	Department of Commerce.
DOE	Department of Energy.
DOI	Department of Interior.
DOJ	Department of Justice.
DOS	Department of State.
DOT	Department of Transportation.
DPA	Delegation of Procurement Authority (granted by GSA under FPRs).
DPC	Defense Procurement Circular.
DQ	Definite Quantity Contract.
DQ/PL	Definite Quantity Price List Contract.
DR	Deficiency Report.
DSCS	Defense Satellite Communication System.
DSN	Defense Switched Network.
DSP	Defense Support Program (WWMCCS).
DSS	Defense Supply Service.
DTC	Design-To-Cost.
ECP	Engineering Change Proposal.
ED	Department of Education.
EEO	Equal Employment Opportunity.
8(a) Set-Aside	Agency awards direct to Small Business Administration for direct placement with a socially/economically disadvantaged company.

EMC	Electro-Magnetic Compatibility.
EMCS	Energy Monitoring and Control System.
EO	Executive Order - Order issued by the President.
EOQ	Economic Ordering Quantity.
EPA	Economic Price Adjustment.
EPA	Environmental Protection Agency.
EPMR	Estimated Peak Monthly Requirement.
EPS	Emergency Procurement Service (GSA) or Emergency Power System.
EUC	End User Computing, especially in DoD.
FA	Formal Advertising.
FAC	Facility Contract.
FAR	Federal Acquisition Regulations.
FCA	Functional Configuration Audit.
FCC	Federal Communications Commission.
FCDC	Federal Contract Data Center.
FCRC	Federal Contract Research Center.
FDPC	Federal Data Processing Center.
FEDSIM	Federal (Computer) Simulation Center (GSA).
FEMA	Federal Emergency Management Agency.
FFP	Firm Fixed-Price Contract (also Lump Sum Contract).
FIPS	NBS Federal Information Processing Standard.
FIPS PUBS	FIPS Publications.
FIRMR	Federal Information Resource Management Regulations.
FMS	Foreign Military Sales.
FOC	Final Operating Capability.
FOIA	Freedom of Information Act.
FP	Fixed-Price Contract.
FP-L/H	Fixed-Price - Labor/Hour Contract.
FP-LOE	Fixed-Price - Level-Of-Effort Contract.
FPMR	Federal Property Management Regulations.
FPR	Federal Procurement Regulations.
FSC	Federal Supply Classification.
FSG	Federal Supply Group.
FSN	Federal Supply Number.
FSS	Federal Supply Schedule or Federal Supply Service (GSA).
FSTS	Federal Secure Telecommunications System.
FT Fund	A revolving fund, designated as the Federal Telecommunications Fund, used by GSA to pay for GSA-provided common-user services, specifically including the current FTS and proposed FTS 2000 services.
FTSP	Federal Telecommunications Standards Program administered by NCS; Standards are published by GSA.
FTS	Federal Telecommunications System.
FTS 2000	Proposed replacement for the Federal Telecommunications System.
FY	Fiscal Year.
FYDP	Five-Year Defense Plan.
GAO	General Accounting Office.
GFE	Government-Furnished Equipment.

GFM	Government-Furnished Material.
GFY	Government Fiscal Year (October to September).
GIDEP	Government-Industry Data Exchange Program.
GOCO	Government Owned - Contractor Operated.
GOGO	Government Owned - Government Operated.
GOSIP	Government Open Systems Interconnection Profile.
GPO	Government Printing Office.
GPS	Global Positioning System.
GRH	Gramm-Rudman-Hollings Act (1985), also called Gramm-Rudman Deficit Control.
GS	General Schedule.
GSA	General Services Administration.
GSBCA	General Services Administration Board of Contract Appeals.
HCFA	Health Care Financing Administration.
HHS	(Department of) Health and Human Services.
HPA	Head of Procuring Activity.
HSDP	High-Speed Data Processors.
HUD	(Department of) Housing and Urban Development.
ICA	Independent Cost Analysis.
ICAM	Integrated Computer-Aided Manufacturing.
ICE	Independent Cost Estimate.
ICP	Inventory Control Point.
ICST	Institute for Computer Sciences and Technology, National Bureau of Standards, Department of Commerce.
IDAMS	Image Display And Manipulation System.
IDEP	Interservice Data Exchange Program.
IDN	Integrated Data Network.
IFB	Invitation For Bids.
IOC	Initial Operating Capability.
IOI	Internal Operating Instructions.
IPS	Integrated Procurement System.
IQ	Indefinite Quantity Contract.
IR&D	Independent Research & Development.
IRM	Information Resources Management.
IXS	Information Exchange System.
JFMIP	Joint Financial Management Improvement Program.
JOCIT	Jovial Compiler Implementation Tool.
JSIPS	Joint Systems Integration Planning Staff.
JSOP	Joint Strategic Objectives Plan.
JSOR	Joint Service Operational Requirement.
JUMPS	Joint Uniform Military Pay System.
LC	Letter Contract.
LCC	Life Cycle Costing.
LCMP	Life Cycle Management Procedures (DD7920.1).

LCMS	Life Cycle Management System.
L-H	Labor-Hour Contract.
LOI	Letter of Interest.
LRPE	Long-Range Procurement Estimate.
LRIRP	Long-Range Information Resource Plan.
MAISRC	Major Automated Information Systems Review Council (DoD).
MANTECH	MANufacturing TECHnology.
MAPS	Multiple Address Processing System.
MAP/TOP	Manufacturing Automation Protocol/Technical and Office Protocol.
MASC	Multiple Award Schedule Contract.
MDA	Multiplexed Data Accumulator.
MENS	Mission Element Need Statement or Mission Essential Need Statement (see DD-5000.1 Major Systems Acquisition).
MILSCAP	Military Standard Contract Administration Procedures.
MIL SPEC	Military Specification.
MIL STD	Military Standard.
MIPR	Military Interdepartmental Purchase Request.
MOD	Modification.
MOL	Maximum Ordering Limit (Federal Supply Service).
MPC	Military Procurement Code.
MYP	Multi-Year Procurement.
NARDIC	Navy Research and Development Information Center.
NASA	National Aeronautics and Space Administration.
NBS	National Bureau of Standards.
NCMA	National Contract Management Association.
NCS	National Communications System; responsible for setting U.S. Government standards administered by GSA; also holds primary responsibility for emergency communications planning.
NICRAD	Navy-Industry Cooperative Research and Development.
NIP	Notice of Intent to Purchase.
NMCS	National Military Command System.
NSA	National Security Agency.
NSEP	National Security and Emergency Preparedness.
NSF	National Science Foundation.
NSIA	National Security Industrial Association.
NTIA	National Telecommunications and Information Administration of the Department of Commerce; replaced the Office of Telecommunications Policy in 1970 as planner and coordinator for government communications programs; primarily responsible for radio.
NTIS	National Technical Information Service.
Obligation	"Earmarking" of specific funding for a contract from committed agency funds.
OCS	Office of Contract Settlement.
OFCC	Office of Federal Contract Compliance.
Off-Site	Services to be provided near but not in government facilities.
OFMP	Office of Federal Management Policy (GSA).

OFPP	Office of Federal Procurement Policy.
OIRM	Office of Information Resources Management.
O&M	Operations & Maintenance.
OMB	Office of Management and Budget.
O,M&R	Operations, Maintenance, and Readiness.
On-Site	Services to be performed on a government installation or in a specified building.
OPM	Office of Procurement Management (GSA) or Office of Personnel Management.
Options	Sole-source additions to the base contract for services or goods to be exercised at the government's discretion.
OSHA	Occupational Safety and Health Act.
OSI	Open System Interconnect.
OSP	Offshore Procurement.
OTA	Office of Technology Assessment (Congress).
Out-Year	Proposed funding for fiscal years beyond the Budget Year (next fiscal year).
P-I	FY Defense Production Budget.
P3I	Pre-Planned Product Improvement (program in DoD).
PAR	Procurement Authorization Request or Procurement Action Report.
PAS	Pre-Award Survey.
PASS	Procurement Automated Source System.
PCO	Procurement Contracting Officer.
PDA	Principal Development Agency.
PDM	Program Decision Memorandum.
PDR	Preliminary Design Review.
PIR	Procurement Information Reporting.
PME	Performance Monitoring Equipment.
PMP	Purchase Management Plan.
PO	Purchase Order or Program Office.
POM	Program Objective Memorandum.
POSIX	Portable Open System Interconnection Exchange.
POTS	Purchase of Telephone Systems.
PPBS	Planning, Programming, Budgeting System.
PR	Purchase Request or Procurement Requisition.
PRA	Paperwork Reduction Act.
PS	Performance Specification - alternative to a Statement of Work, when work to be performed can be clearly specified.
QA	Quality Assurance.
QAO	Quality Assurance Office.
QMCS	Quality Monitoring and Control System (DoD software).
QMR	Qualitative Material Requirement (Army).
QPL	Qualified Products List.
QRC	Quick Reaction Capability.
QRI	Quick Reaction Inquiry.
R-I	FY Defense RDT&E Budget.
RAM	Reliability, Availability, and Maintainability.
RC	Requirements Contract.

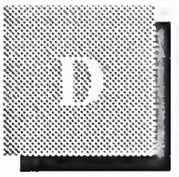
R&D	Research and Development.
RDA	Research, Development, and Acquisition.
RDD	Required Delivery Date.
RD&E	Research, Development, and Engineering.
RDF	Rapid Deployment Force.
RDT&E	Research, Development, Test, and Engineering.
RFI	Request For Information.
RFP	Request For Proposal.
RFQ	Request For Quotation.
RFTP	Request For Technical Proposals (Two-Step).
ROC	Required Operational Capability.
ROI	Return On Investment.
RTAS	Real Time Analysis System.
RTDS	Real Time Display System.
SA	Supplemental Agreement.
SBA	Small Business Administration.
SB Set-Aside	Small Business Set-Aside contract opportunities with bidders limited to certified small businesses.
SCA	Service Contract Act (1964 as amended).
SCN	Specification Change Notice.
SDN	Secure Data Network.
SEC	Securities and Exchange Commission.
SE&I	Systems Engineering and Integration.
SETA	Systems Engineering/Technical Assistance.
SETS	Systems Engineering/Technical Support.
SIBAC	Simplified Intragovernmental Billing and Collection System.
SIMP	Systems Integration Master Plan.
SIOP	Single Integrated Operations Plan.
SNAP	Shipboard Nontactical ADP Program.
Sole Source	Contract award without competition.
Solicitation	Invitation to submit a bid.
SOR	Specific Operational Requirement.
SOW	Statement of Work.
SSA	Source Selection Authority (DoD).
SSAC	Source Selection Advisory Council.
SSEB	Source Selection Evaluation Board.
SSO	Source Selection Official (NASA).
STINFO	Scientific and Technical INFOrmation Program - Air Force/NASA.
STU	Secure Telephone Unit.
SWO	Stop-Work Order.
Synopsis	Brief Description of contract opportunity in CBD after D&F and before release of solicitation.
TA/AS	Technical Assistance/Analysis Services.
TCP/IP	Transmission Control Protocol/Internet Protocol.

TEMPEST	Studies, inspections, and tests of unintentional electromagnetic radiation from computer, communication, command, and control equipment that may cause unauthorized disclosure of information; usually applied to DoD and security agency testing programs.
TILO	Technical and Industrial Liason Office—Qualified Requirement Information Program - Army.
TM	Time and Materials contract.
TOA	Total Obligational Authority (Defense).
TOD	Technical Objective Document.
TR	Temporary Regulation (added to FPR, FAR).
TRACE	Total Risk Assessing Cost Estimate.
TRCO	Technical Representative of the Contracting Offices.
TREAS	Department of Treasury.
TRP	Technical Resources Plan.
TSP	GSA's Teleprocessing Services Program.
TVA	Tennessee Valley Authority.
UCAS	Uniform Cost Accounting System.
USA	U.S. Army.
USAF	U.S. Air Force.
USCG	U.S. Coast Guard.
USMC	U.S. Marine Corps.
USN	U.S. Navy.
U.S.C.	United States Code.
USPS	United States Postal Service.
USRRB	United States Railroad Retirement Board.
VA	Veterans Affairs Department.
VE	Value Engineering.
VHSIC	Very High Speed Integrated Circuits.
VIABLE	Vertical Installation Automation BaseLine (Army).
VICI	Voice Input Code Identifier.
WBS	Work Breakdown Structure.
WGM	Weighted Guidelines Method.
WIN	WWMCCS Intercomputer Network.
WITS	Washington Interagency Telecommunications System.
WIS	WWMCCS Information Systems.
WS	Work Statement - Offerer's description of the work to be done (proposal or contract).
WWMCCS	World-Wide Military Command and Control System.

B

General and Industry Acronyms

ADAPSO	Association of Data Processing Service Organization, now the Computer Software and Services Industry Association.
ADP	Automatic Data Processing.
ADPE	Automatic Data Processing Equipment.
ANSI	American National Standards Institute.
BOC	BELL Operating Company.
CAD	Computer-Aided Design.
CAM	Computer-Aided Manufacturing.
CBEMA	Computer and Business Equipment Manufacturers Association.
CCIA	Computers and Communications Industry Association.
CCITT	Comite Consultaif Internationale de Telegraphique et Telephonique; Committee of the International Telecommunication Union.
COBOL	COmmon Business-Oriented Language.
COS	Corporation for Open Systems.
CPU	Central Processor Unit.
DMBS	Data Base Management System.
DRAM	Dynamic Random Access Memory.
EIA	Electronic Industries Association.
EPROM	Erasible Programmable Read-Only-Memory.
IEEE	Institute of Electrical and Electronics Engineers.
ISDN	Integrated Services Digital Networks.
ISO	International Organization for Standardization; voluntary international standards organization and member of CCITT.
ITU	International Telecommunication Union.
LSI	Large-Scale Integration.
MFJ	Modified Final Judgement.
PROM	Programmable Read-Only Memory.
RBOC	Regional Bell Operating Company.
UNIX	AT&T Proprietary Operating System.
UPS	Uninterruptable Power Source.
VAR	Value Added Retailer.
VLSI	Very Large Scale Integration.
WORM	Write-Once-Read-Many-Times.



Policies, Regulations, and Standards

A

OMB Circulars

A-11	Preparation and Submission of Budget Estimates.
A-49	Use of Management and Operating Contracts.
A-71	Responsibilities for the Administration and Management of Automatic Data Processing Activities.
A-109	Major Systems Acquisitions.
A-120	Guidelines for the Use of Consulting Services.
A-121	Cost Accounting, Cost Recovery, and Integrated Sharing of Data Processing Facilities.
A-123	Internal Control Systems.
A-127	Financial Management Systems.
A-130	Management of Federal Information Resources.
A-131	Value Engineering.

B

GSA Publications

The FIRMR as published by GSA is the primary regulation for use by federal agencies in the management, acquisition, and use of both ADP and telecommunications information resources.

C

DoD Directives

DD-5000.1	Major System Acquisitions.
DD-5000.2	Major System Acquisition Process.
DD-5000.11	DoD Data Elements and Data Codes Standardization Program.
DD-5000.31	Interim List of DoD-Approved, High-Order Languages.
DD-5000.35	Defense Acquisition Regulatory Systems.
DD-5200.1	DoD Information Security Program.
DD-5200.28	Security Requirements for Automatic Data Processing (ADP) Systems.

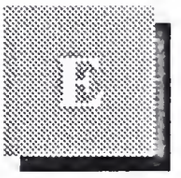
DD-5200.28-M	Manual of Techniques and Procedures for Implementing, Deactivating, Testing, and Evaluating Secure Resource Sharing ADP Systems.
DD-7920.2	Major Automated Information Systems Approval Process.
DD-7935	Automated Data Systems (ADS) Documentation.

D

Standards

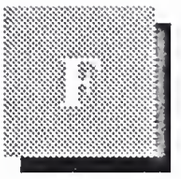
ADCCP	Advanced Data Communications Control Procedures; ANSI Standard X3.66 of 1979; also NIST FIPS 71.
CCITT G.711	International PCM standard.
CCITT T.0	International standard for classification of facsimile apparatus for document transmission over telephone-type circuits.
DEA-1	Proposed ISO standard for data encryption based on the NIST DES.
EIA RS-170	Monochrome video standard.
EIA RS-170A	Color video standard.
EIA RS-464	EIA PBX standards.
EIA RS-465	Standard for Group III facsimile.
EIA RS-466	Facsimile standard; procedures for document transmission in the General Switched Telephone Network.
EIA RS-232-C	EIA DCE to DTE interface standard using a 25-Pin connector; similar to CCITT V-24.
EIA RS-449	New EIA standard DTE to DCE interface which re places RS-232-C.
FED-STD 1000	Proposed Federal Standard for adoption of the full OSI reference model.
FED-STD 1026	Federal Data Encryption Standard (DES) adopted in 1983; also FIPS 46.
FED-STD 1041	Equivalent to FIPS 100.
FED-STD 1061	Group II Facsimile Standard (1981).
FED-STD 1062	Federal standard for Group III facsimile; equivalent to EIA RS-465.
FED-STD 1063	Federal facsimile standard; equivalent to EIA RS-466.
FED-STDs 1005, 1005A-1008	Federal Standards for DCE Coding and Modulation.
FIPS 46	NIST Data Encryption Standard (DES).
FIPS 81	DES Modes of Operation.

FIPS 100	NIST Standard for packet-switched networks; subset of 1980 CCITT X.25.
FIPS 107	NIST Standard for local-area networks, similar to IEEE 802.2 and 802.3.
FIPS 146	Government Open Systems Interconnection (OSI) Profile (GOSIP).
FIPS 151	NIST POSIX (Portable Operating System Interface for UNIX) standard.
IEEE 802.2	OSI-Compatible IEEE standard for data-link control in local-area networks.
IEEE 802.3	Local-area network standard similar to Ethernet.
IEEE 802.4	OSI-compatible standard for token bus local-area networks.
IEEE 802.5	Local-area networks standard for token ring networks.
IEEE P1003.1	POSIX standard, similar to FIPS 151.
MIL-STD-188-114C	Physical interface protocol similar to RS-232 and RS-449.
MIL-STD-1777	IP-Internet Protocol.
MIL-STD-1778	TCP - Transmission Control Protocol.
MIL-STD-1780	File Transfer Protocol.
MIL-STD-1781	Simple Mail Transfer Protocol (electronic mail).
MIL-STD-1782	TELNET - virtual terminal protocol.
MIL-STD-1815A	Ada Programming Language Standard.
SVID	UNIX System Interface Definition.
X12	ANSI standard for Electronic Data Interchange
X.21	CCITT standard for interface between DTE and DCE for synchronous operation on public data networks.
X.25	CCITT standard for interface between DTE and DCE for terminals operating in the packet mode on public data networks.
X.75	CCITT standard for links that interface different packet networks.
X.400	ISO application-level standard for the electronic transfer of messages (electronic mail).



Related INPUT Reports

- *Federal Systems Integration, 1991-1996*
- *Federal Electronic Imaging, 1991-1996*
- *Federal Geographic Information Systems, 1991-1996*
- *Federal Computer Equipment Market, 1991-1996*
- *Federal Equipment Maintenance, 1990-1995*
- *Federal Professional Services Market, 1990-1995*
- *U.S. Application Solutions Market, 1991-1996*
- *U.S. Systems Image Processing, 1990-1995*



Agency Questionnaire

Confidential
INPUT Questionnaire
NASA Headquarters—Planning Office

Catalog No. _____

Study Title: *NASA Information Services Market, 1991-1996*

Study Code: FINA2

Date: _____

Type of Interview:

____	Buyer	____	Telephone
____	User	____	On-Site
____	Policy	____	Mail

Interviewer: _____

NASA Headquarters Office: _____

Address: _____ **Office Code:** _____

_____

_____

_____

Name: _____ **Title:** _____

Telephone Number: _____

1. Name of Program/Office: _____

2. Major Function of Office/Program: _____

_____

3. Organizational Overview/Position within NASA HDQ or Program Offices:

_____

_____

Confidential

NASA Information Technology Questionnaire—1991

Planning Process

1. Do the Centers still prepare their own plans independently?

   Yes ____ No ____

   a. If yes, are the planning documents prepared by the individual Centers available to the public?

   Yes ____ No ____

   b. If yes, how may we obtain a copy?

   _____

   _____

   c. If the plans are not available, can you summarize the contents?

   _____

   _____

   _____

   _____

2. What is the relationship between Headquarters ISP activities and those at the Centers?

   a. Are all NASA Centers required to submit IS plans to NASA HQ IRM Office?

   Yes ____ No ____

   b. If yes, how often?

   _____

3. How would you characterize the level of decentralization of NASA ISP activities?

   _____

   _____

4. How does NASA's overall planning process support the agency's IS modernization efforts?

   _____

5. Are plans updated to reflect external pressures, such as Congressional funding decisions?

   _____

   _____

6. Does NASA's Intercenter Committee on ADP still exist?

   Yes ____ No ____

   a. What is its function?

   _____

   _____

7. Do IS plans reflect mission goals and objectives, or focus primarily on technology progress in NASA?

Information Systems Acquisition Plans

8. Do you expect funding to increase or decrease? Why?

9. What mission changes, if any, are driving a change in information services?

   a. Other factors?

   b. What mechanisms are in place to receive and disseminate information from the research centers and space flight centers for planning purposes?

10. For each space and research center, please identify one major computer system or program which best typifies that center's usage of information technology—or give us a reference.

a. Johnson:

b. Ames:

c. Marshall:

d. Langley:

e. Goddard:

f. Lewis:

g. Kennedy:

h. Jet Propulsion:

(NOTE: How might information on those systems be obtained? List of sources available to public and points of contact).

_____

_____

_____

11. Which centers are projected to be contracting the largest share of the IT budget for FY 1992? For which programs?

_____

_____

_____

12. What do you view as the three most significant major NASA initiatives for FY 1991-FY 1996?

_____

_____

_____

a. Which center will play the most important role for each program?

Program	Center
1. _____	1. _____
_____	_____
2. _____	2. _____
_____	_____
3. _____	3. _____
_____	_____

13. How has systems integration aided in the completion of NASA's missions and objectives?

_____

_____

a. Do you see it continuing to play an important role?

_____

_____

_____

14. How will technological improvements in each of these areas alter the way NASA accomplishes information processing?

a. AI: _____

_____

b. Optical Disk Storage: _____

_____

c. End-User Computing: _____

_____

d. Local-Area Networks: _____

_____

e. Fiber Optics: _____

_____

f. Imaging: _____

_____

g. What additional technology improvements do you see developing over the next five years that will impact NASA?

_____

_____

15. Are the following still considered key technology areas at NASA?

    a. Data Management and Storage? Yes ____ No ____

    b. Telecommunications? Yes ____ No ____

    c. Software? Yes ____ No ____

    d. Are there others? _____

    _____

16. For each, please describe key technology as it relates to NASA (trends affecting NASA, use of the technology within NASA, etc.).

    a. Data Management and Storage:

    _____

    _____

    _____

    _____

    b. Telecommunications:

    _____

    _____

    _____

    _____

    c. Software:

    _____

    _____

    _____

    _____

17. What future legislation do you see influencing NASA's use of information technology? (Computer Security, Gramm-Rudman, etc.)

18. What legislation has impacted NASA most significantly over the past two years?

19. What future legislation do you see influencing NASA's use of information technology? (Computer Security, Gramm-Rudman, etc.)

20. How has application downsizing affected IRM at NASA?

About INPUT

Company Profile

INPUT provides planning information, analysis, and recommendations to managers and executives in the information services industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services (software products, processing and network services, systems management, and systems/software maintenance and support).

Many of INPUT's professional staff have more than 20 years' experience in their areas of specialization. Most have held management positions in large organizations, enabling them to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

Staff Credentials

INPUT's staff have been selected for their broad background in a variety of functions, including planning, marketing, operations, and information processing. Many of INPUT's professional staff have held executive positions in some of the world's leading organizations, both as vendors and users of information services, in areas such as the following:

- Processing Services
- Professional Services
- Turnkey Systems
- Applications Software
- Field (customer) Service
- Banking and Finance
- Insurance
- Process Manufacturing
- Telecommunications
- Federal Government

Educational backgrounds include both technical and business specializations, and many INPUT staff hold advanced degrees.

U.S. and European Advisory Services

INPUT offers the following advisory services on an annual subscription basis.

1. Market Analysis Program—U.S.
The Market Analysis Program provides up-to-date U.S. information services market analyses, five-year forecasts, trend analyses, vertical/cross-industry market reports, an on-site presentation, hotline inquiry service, and sound recommendations for action. It covers software products, turnkey systems, processing and network services, and professional services markets. It is designed to satisfy the planning and marketing requirements of current and potential information services vendors.

2. Market Analysis Program—Europe
This program is designed to help vendors of software and services with their market planning. It examines the issues in the marketplace, from both a user and a vendor viewpoint. It provides detailed five-year market forecasts to help plan for future growth.

3. Vendor Analysis Program—U.S.
A comprehensive reference service covering more than 400 U.S. information services vendor organizations, VAP is often used for competitive analysis and prescreening of acquisition and joint-venture candidates. Profiles on leading vendors are updated regularly, and hotline inquiry service is provided.

4. Vendor Analysis Program—Europe
This is an invaluable service for gaining competitive information and for seeking targets for partnerships or acquisitions. The service provides profiles on some 450 European software and services vendors. A hotline enquiry service provides details on companies not covered by the profiles.

5. Electronic Data Interchange Program
Focusing on what is fast becoming a major computer/communications market opportunity, this program keeps you well informed. Through monthly newsletters, timely news flashes, comprehensive studies, and telephone inquiry privileges, you will be informed and stay informed about the events and issues impacting this burgeoning market.

6. Network Services Program—Europe
Network services is a fast-growing area of the software and services industry. This program is essential to vendors of EDI, electronic information services, and network products and services, keeping clients informed of the latest developments in the European marketplace.

7. Systems Integration Program—U.S.
Focus is on the fast-moving world of systems integration and the provision of complex information systems requiring vendor management and installation of multiple products and services. The program includes an annual market analysis of the U.S. systems integration market, SI vendor profiles and updates, topical market analysis reports, and an annual SI seminar.

8. Systems Operations Program—U.S.
This program focuses on the exciting resurgence of the market for outsourcing systems operations. It includes an annual market analysis report of the systems operations market, SO vendor profiles and updates, topical market analysis reports, and an annual SO seminar.

9. Systems Management Program—Europe
Systems integration and systems operations (facilities management) are key growth areas for the decade. This program examines these two areas and analyzes current market trends, user needs, and vendor offerings.

10. Federal Information Systems and Services Program
This program presents highly specific information on U.S. federal government procurement practices, identifies information services vendor opportunities, and provides guidance from INPUT's experienced Washington professionals to help clients maximize sales effectiveness in the federal government marketplace.

11. State Information Systems and Services Program (proposed)
This program presents extensive information on state government spending, procurement policies, identifies key contacts, opportunities, and provides guidance from INPUT's experienced professionals to help clients maximize sales opportunities in the state government marketplace.

12. Information Systems Program
ISP is designed for executives of large information systems organizations and provides crucial information for planning, procurement, and management decision making. This program is widely used by both user and vendor organizations.

13. Customer Service Program—International
This program provides customer service organization management with data and analyses needed for marketing, technical, financial, and organizational planning. The program pinpoints user perceptions of service received, presents vendor-by-vendor service comparisons, and analyzes and forecasts service markets for large systems, minicomputers, personal computer systems, and third-party maintenance. A monthly newsletter helps clients keep informed of the latest developments in the market.

14. Customer Service Program—Europe
Customer service is an expanding area. Companies are now expanding from hardware service to more software-related maintenance and professional services. This program helps vendors penetrate these new areas and provides guidelines for future market strategy. A monthly newsletter helps clients keep abreast of the latest developments in the market.

15. Worldwide Information Services Market Forecasts
In 1989 INPUT initiated this research study, which provides an international forecast for the information services market.

Customized Advisory Services

In addition to standard continuous-information programs, INPUT will work with you to develop and provide a customized advisory service that meets your unique requirements.

Acquisition Services

INPUT also offers acquisition services that are tailor-made for your requirements. INPUT's years of experience and data base of company information about information systems and services companies have helped many companies in their acquisition processes.

An Effective Combination

INPUT'S Executive Advisory Services are built on an effective combination of research-based studies, client meetings, informative conferences, and continuous client support. Each service is designed to deliver the information you need in the form most useful to you, the client. Executive Advisory Services are composed of *varied combinations of the following products and services:*

Research-Based Studies
Following a proven research methodology, INPUT conducts major research studies throughout each program year. Each year INPUT selects issues of concern to management. Topical reports are prepared and delivered throughout the calendar year.

Information Service Industry Reports
INPUT's Executive Advisory Services address specific issues, competitive environments, and user expenditures relative to:

- Software Products
- Processing Services
- Network Services
- Systems Integration
- Systems Operations
- Professional Services
- Turnkey Systems
- Small-Systems Service
- Third-Party Maintenance
- Large-Systems Service

Industry-Specific Market Reports

Detailed analyses of market trends, forces driving the markets, problems, opportunities, and user expenditures are available for the following sectors:

- Discrete Manufacturing
- Process Manufacturing
- Transportation
- Utilities
- Telecommunications
- Retail Distribution
- Wholesale Distribution
- Banking and Finance
- Insurance
- Medical
- Education
- Business Services
- Consumer Services
- Federal Government
- State and Local Government
- Miscellaneous Industries

Cross-Industry Market Report

A separate analysis covers the following cross-industry application areas:

- Accounting
- Education and Training
- Engineering and Scientific
- Human Resources
- Office Systems
- Planning and Analysis
- Other Cross-Industry Sectors

Hotline: Client Inquiry Services

Inquiries are answered quickly and completely through use of INPUT's Client Hotline. Clients may call any INPUT office (San Francisco, New York, Washington D.C., London, or Paris) during business hours or they may call a voicemail service to place questions after hours. This effective Hotline service is the cornerstone of every INPUT Executive Advisory Service.

The Information Center

One of the largest and most complete collections of information services industry data, the Information Center houses literally thousands of up-to-date files on vendors, industry markets, applications, current/emerging technologies, and more. Clients have complete access to the Information Center. In addition to the information contained in its files, the center maintains an 18-month inventory of over 130 major trade publications, vendor consultant manuals, economic data, government publications, and a variety of important industry documents.

Access to INPUT Professional Staff

Direct access to INPUT's staff, many of whom have more than 20 years of experience in the information industry, provides you with continuous research and planning support. When you buy INPUT, you buy experience and knowledge.

Client Conference

You can attend INPUT's Client Conference. This event addresses the status and future of the information services industry, the competitive environment, important industry trends potentially affecting your business, the impact of new technology and new service offerings, and more.

You will attend with top executives from many of the industry's leading, fastest-growing, and most successful vendor companies—and with top Information Systems (IS) managers from some of the world's most sophisticated user organizations.

On-Site Presentation by INPUT Executives

Many of INPUT's programs offer an informative presentation at your site. Covering the year's research, this session is scheduled at the convenience of the client.

Proprietary Research Service

INPUT conducts proprietary research that meets the unique requirements of an individual client. INPUT's custom research is effectively used:

For Business Planning

Planning for new products, planning for business startups, planning for expansion of an existing business or product line—each plan requires reliable information and analysis to support major decisions. INPUT's dedicated efforts and custom research expertise in business planning ensure comprehensive identification and analysis of the many factors affecting the final decision.

For Acquisition Planning

Successful acquisition and divestiture of information services companies requires reliable information. Through constant contact with information services vendor organizations and continuous tracking of company size, growth, financials, and management "chemistry," INPUT can provide the valuable insight and analysis you need to select the most suitable candidates.

For the Total Acquisition Process

INPUT has the credentials, the data base of company information, and—most importantly—the contacts to assist you with total acquisition and/or partnering relationship processes:

- Due Diligence
- Schedules and Introduction
- Criteria & Definitions
- Retainer and Fee-Based
- Active Search

For Competitive Analysis

Knowing marketing and sales tactics, product capabilities, strategic objectives, competitive postures, and strengths and weaknesses of your competition is as critical as knowing your own. The career experience of INPUT's professionals—coupled with INPUT's collection and maintenance of current financial, strategic, tactical, and operational information about more than 400 active companies—uniquely qualifies INPUT to provide the best competitive information available today.

For Market and Product Analysis

Developing new products and entering new markets involves considerable investment and risk. INPUT regularly conducts research for clients to identify product requirements, market dynamics, and market growth.

More About INPUT...

- More than 5,000 organizations, worldwide, have charted business directions based on INPUT's research and analysis.
- Many clients invest more than $50,000 each year to receive INPUT's recommendations and planning information.
- INPUT regularly conducts proprietary research for some of the largest companies in the world.
- INPUT has developed and maintains one of the most complete information industry libraries in the world (access is granted to all INPUT clients).
- INPUT clients control an estimated 70% of the total information industry market.
- INPUT analyses and forecasts are founded upon years of practical experience, knowledge of historical industry performance, continuous tracking of day-to-day industry events, knowledge of user and vendor plans, and business savvy.
- INPUT analysts accurately predicted the growth of the information services market—at a time when most research organizations deemed it a transient market. INPUT predicted the growth of the microcomputer market in 1980 and accurately forecasted its slowdown in 1984.

For More Information . . .

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